Five trends driving the emergence of the personalized health ecosystem

The COVID-19 pandemic provides the 'burning platform' for accelerating the data agenda

April 2020

EY

Building a better working world

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New data-based tools and technologies make a more personalized approach to health and wellness possible. The world has never needed this more than now. While companies and organizations long recognized the potential of new tools to capture and use data to transform health, they lacked the "burning platform" to fuel this change. The COVID-19 pandemic — and the global disruption it has caused — has demonstrated that organizations have the opportunity to become more resilient, agile and innovative if they shift to digitally enabled business models with data at the core.

The emergence of COVID-19 represents a pivotal demarcation between before and after. The far-reaching global consequences are still unfolding, but we know that after the pandemic the world will be fundamentally different. Workforces, supply chains and economies will be transformed by the massive disruption the pandemic has caused and by the global efforts to respond to it. These efforts include, among others, the shift toward remote working, the increased reliance on connected digital technologies to augment the work and social experience, and the need to redesign and potentially localize supply chains.

For global health organizations, the crisis highlights systemic challenges related to care, including spiraling costs, inadequate infrastructure and older, sicker populations. Tackling these challenges — like tackling the pandemic — requires close stakeholder collaboration, identification of shared goals and a commitment to create interoperable systems for data sharing and usage.

Most immediately, health sciences and wellness organizations have prioritized maintaining business continuity — mitigating risks associated with the physical and human supply chain, managing the sudden decentralization of workforces and simultaneously waging the frontline clinical and scientific battle against the spread of the pandemic.

If the crisis has a silver lining, it is that there is now a case for investing in the significant organizational changes required to effectively unlock the power of health data, whether this data is used to fight future infectious outbreaks or slower-burning diseases such as diabetes, heart disease and cancer. As Rachel Dunscombe, CEO of the United Kingdom's National Health Service Digital Academy (an organization established to accelerate the NHS' transformation through information and technology), says, "Data is for life, not just for one system." Liberating the value of health care data ultimately requires the development of a new personalized health ecosystem in which data drives better outcomes for all stakeholders.

In this paper we concentrate on five areas where organizations must focus their efforts to build this potential data-driven future:
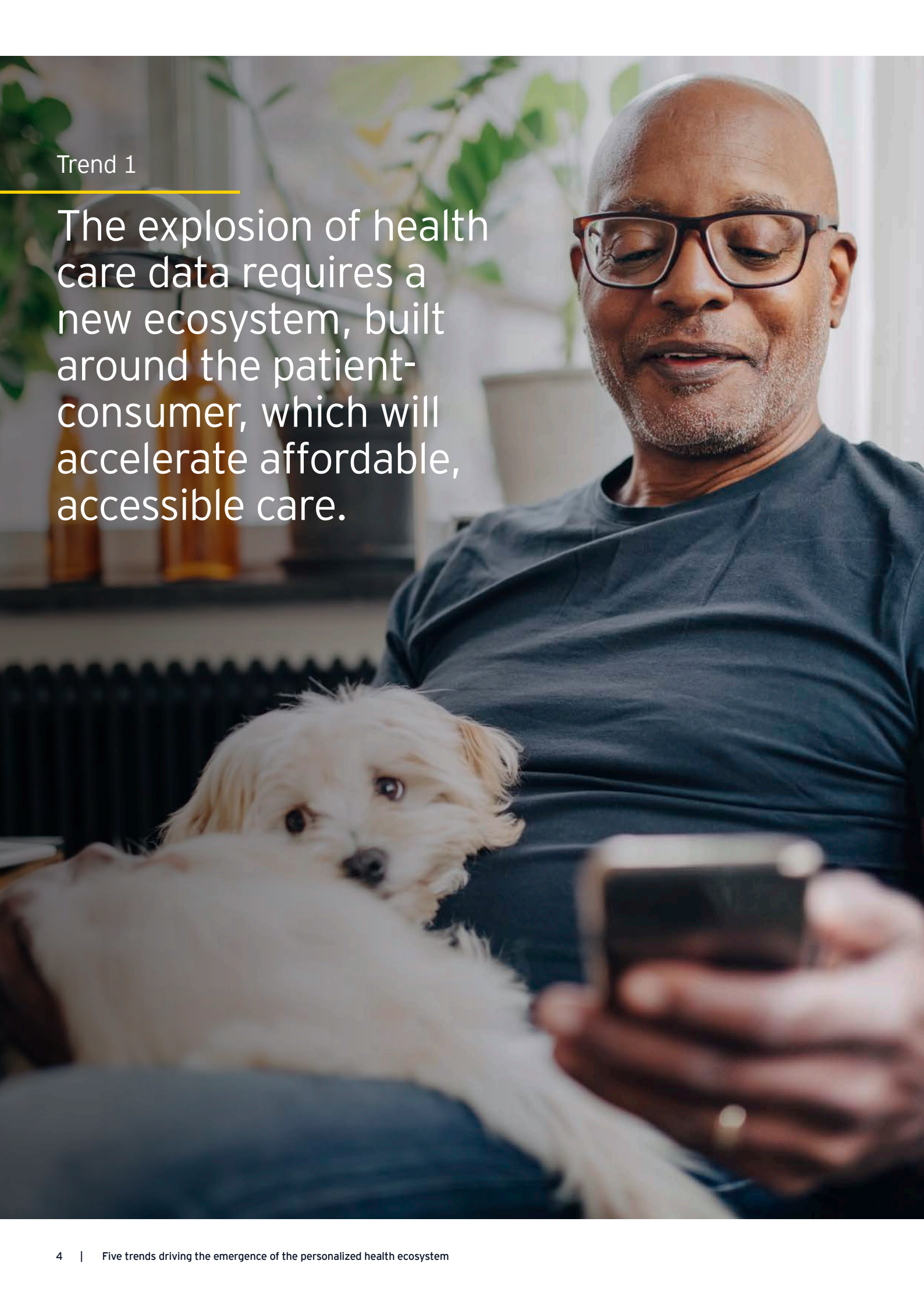
1. Building a collaborative ecosystem

2. Embedding data-generating technologies into the care paradigm

3. Incorporating behavioral science into products and services

4. Enabling stakeholder trust

5. Adapting business models

There are still major challenges to realizing the vision of a personalized health ecosystem. But the companies that focus on creating truly patient-centered, data-driven products and offerings have the greatest opportunity to lead the transformation of health and wellness.

	Now	Next	Beyond	
Trend 1 The explosion of health care data requires a new ecosystem, built around the patient-consumer, which will accelerate affordable, accessible care.	COVID-19 has shown how rapidly and effectively data can be captured, shared and used, rather than fragmented across multiple organizations.	We will see a move toward more integrated and individualized data streams centered on the individual.	A hyper-personalized, patient-centered ecosystem, delivering affordable, accessible care, will emerge from the richer levels of collaboration and data-sharing between stakeholders.	04
Trend 2 With sensors in, on and around us, 5G and artificial intelligence will create a new network transforming health care.	Sensors, AI and 5G have shown their utility as important tools for addressing COVID-19, accelerating their maturity.	Sensors will become increasingly diversified and widespread, with 5G networks gaining penetration and AI growing in scope and power.	Sensors will be ubiquitous, providing rich, continuous data for real-time AI analysis.	08
Trend 3 To personalize health, organizations must use data to understand and influence behavior.	Behavioral science has been used worldwide to try to contain the COVID-19 threat, yet it has only marginal use in health care under normal circumstances.	Bigger datasets and more powerful AI feedback loops will allow organizations to offer a better mix of products and personalized services and behavioral solutions.	Behavioral feedback and steering will be embedded throughout the individual's environment, driving personalized strategies for optimized health outcomes.	12
Trend 4 A trusted intelligence system is needed to secure the participation of the patient-consumer and other stakeholders.	Trust and collaboration between stakeholders have been required to manage the COVID-19 pandemic, even as challenges remain.	There will be an increased drive to build the trusted systems that can enable better collaboration, with rising cybersecurity standards and more powerful, unlocked AI entering the market.	A secure, patient-centered ecosystem will develop, allowing permissioned data sharing and trusted intelligence interfaces.	15
Trend 5 Organizations must be decisive in the business model they choose to pursue in the future.	Most organizations' capital is currently deployed across multiple business models with limited specialization and inadequate data and services capabilities.	Organizations will continue to focus their business models based on the data-driven outcomes they can deliver for their target customers.	Organizations will optimize their role within the future operating system with a more efficient and flexible mix of data-driven products and services.	18

Trend 1

The explosion of health care data requires a new ecosystem, built around the patient-consumer, which will accelerate affordable, accessible care.

Global efforts to rapidly contain COVID-19 demonstrate that health care data are exponentially more powerful if they can be collected, connected, combined and shared. In South Korea, for example, the Government mounted a rapid response, tracking the disease by collecting data including first-hand testimony, CCTV imagery and anonymized information from people testing positive (such as smartphone and credit card records).

These data were integrated and their insights shared through social media apps, allowing citizens to visualize the spread of the disease and minimize their risk of contact.[1] Unfortunately, this has been the exception rather than the rule. In most geographies, data are trapped in siloes, fragmented across different systems and different organizations, making them impossible to rapidly integrate and analyze, and limiting their effectiveness in assisting with real-time health care efforts.

This is not a new problem. We are living through an unprecedented explosion of health data. In 2018 alone, the health care sector generated an estimated 1,218 exabytes of data, 100 times more than all the data humankind generated in its history up to the year 2000 (see Figure 1). This level of data generation poses global challenges – for example, around sustainability, with global data transfer and its

infrastructure now responsible for a larger share of global carbon emissions than the aerospace industry.[2]

Yet the opportunities created by this data explosion are even more significant than the challenges it presents. If it were possible to integrate and analyze this data, health care could be transformed. In a lifetime, an individual generates huge quantities of personal health data in multiple formats and locations. Yet, with these data scattered across multiple siloes, all they show is a series of isolated "snapshots" of a person's health. Integrating these data can turn the fragmented snapshots into a continuous movie, giving us a richer, fuller understanding of the patient's health outlook, challenges and needs. It is possible to envisage a future system built around using that richer data to deliver better outcomes (see Figure 2).

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1 See, e.g., Dennis Normile, "Coronavirus cases have dropped sharply in South Korea. What's the secret to its success?" *Science*. March 17, 2020. https://www.sciencemag.org/news/2020/03/coronavirus-cases-have-dropped-sharply-south-korea-whats-secret-its-success#.

2 "Lean ICT: Towards Digital Sobriety," *The Shift Project*, https://theshiftproject.org/wp-content/uploads/2019/03/Lean-ICT-Report_The-Shift-Project_2019.pdf.

Figure 1: The exponential growth of health care data

In 2000, all human-produced data in all media represented ~12 exabytes.

In 2018, health care alone generated ~100 times that much data.
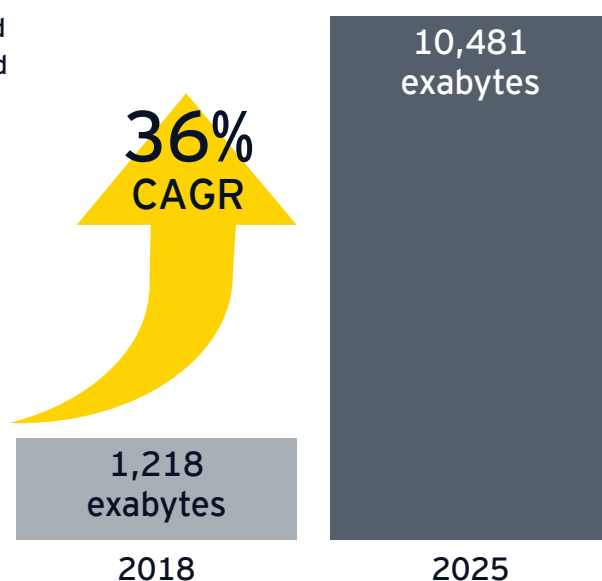
By 2025, health care's annual data output is predicted to increase more than 8.5 times.

The challenge will be to design the systems that can use this data effectively.

Source: IDC, "The DataAge 2025," November 2018; *Wired* magazine, May 2019.

Addressing this challenge and imagining this potential future ecosystem requires a new way of thinking: organizations must focus less on owning and monetizing data and more on connecting and combining it to drive valuable insights that can transform health care.

However, this sharing will also reduce organizations' proprietary control over data and expose them to competition from other vendors and developers.
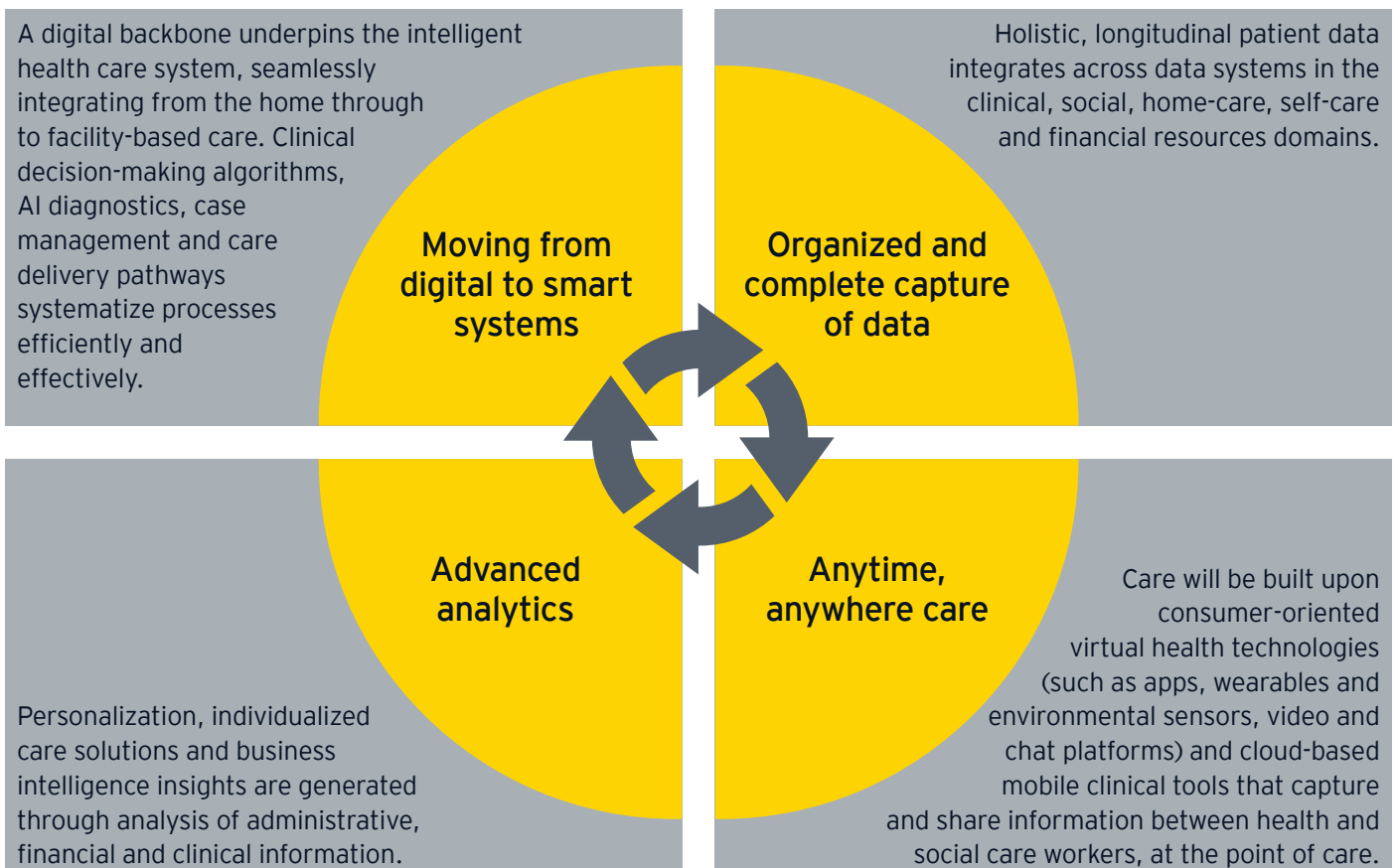
Since it also raises meaningful concerns about patient privacy, the principle of data sharing has met stiff opposition in the past. But to truly protect the patient's best interests, privacy concerns must be balanced against the power of open access platforms to drive innovation and the adoption of innovation at scale.

The best way to accelerate health innovations is by jettisoning protectionist attitudes to data. Instead, we must think in terms of a more fundamental power shift that puts individuals at the center of a broader health ecosystem (see Figure 3).

The individual should have ownership and control over all their health data in the same way that they control their bank accounts and financial assets. Each person would be able to choose which parties have access to which data, based on what they believe will maximize their own health opportunities.
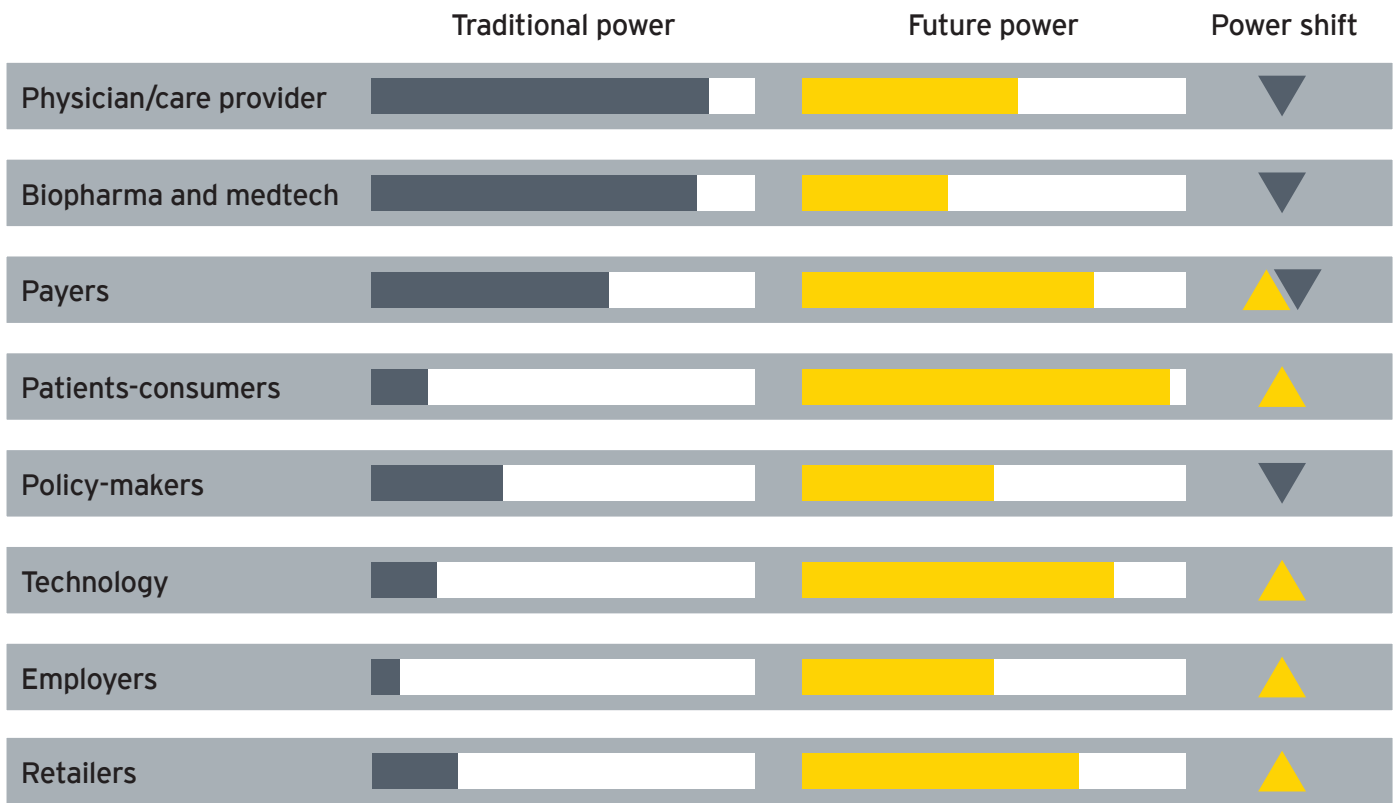
Studies have repeatedly shown that patients are healthier and more compliant with their prescriptions when they are actively engaged with their own health. A patient-centered ecosystem would make that engagement the new normal. This rebooting of the health system could also potentially make health care more affordable and accessible. If connected data can make health more personalized and targeted, it will greatly reduce the amount spent on inappropriate care, enabling better economic, as well as clinical, outcomes.

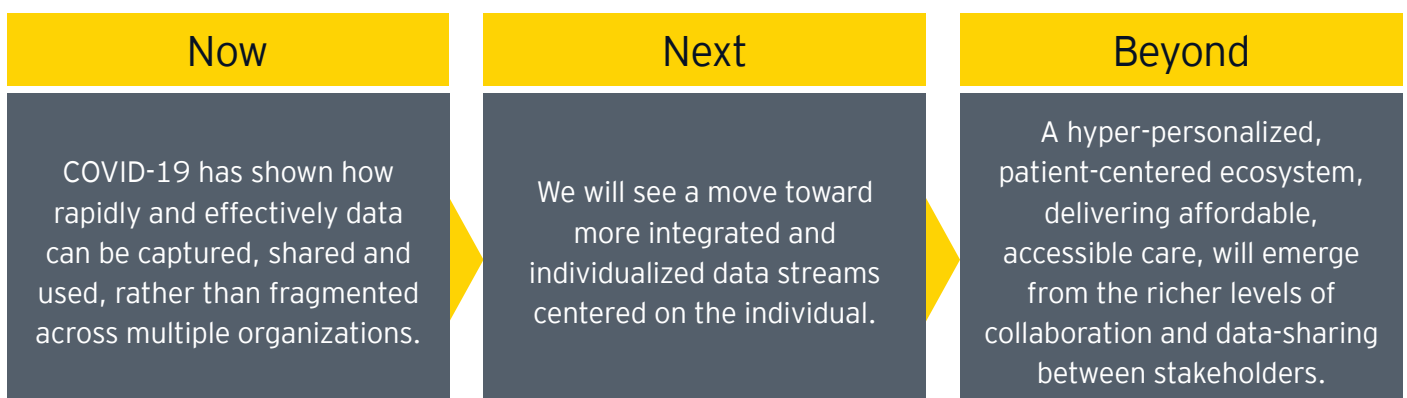## Figure 2: The potential health care data ecosystem of the future

A digital backbone underpins the intelligent health care system, seamlessly integrating from the home through to facility-based care. Clinical decision-making algorithms, AI diagnostics, case management and care delivery pathways systematize processes efficiently and effectively.

Moving from digital to smart systems

Holistic, longitudinal patient data integrates across data systems in the clinical, social, home-care, self-care and financial resources domains.

Organized and complete capture of data

Advanced analytics

Personalization, individualized care solutions and business intelligence insights are generated through analysis of administrative, financial and clinical information.

Anytime, anywhere care

Care will be built upon consumer-oriented virtual health technologies (such as apps, wearables and environmental sensors, video and chat platforms) and cloud-based mobile clinical tools that capture and share information between health and social care workers, at the point of care.

Source: EY.

Figure 3: Power will shift significantly between different stakeholder groups in the future

|	Traditional power	Future power	Power shift
Physician/care provider	███████	████	▼
Biopharma and medtech	███████	██	▼
Payers	█████	██████	▲▼
Patients-consumers	█	███████	▲
Policy-makers	██	███	▼
Technology	█	█████	▲
Employers	▪	███	▲
Retailers	██	████	▲

Source: EY.

To build this new ecosystem, organizations must:

‣ Give individuals ownership and control over their data so that they will have more power over their own care.

‣ Understand that data is no longer an asset to be owned, monetized and siloed, but rather, curated and shared to drive better outcomes.

‣ Recognize that personalizing health also has the potential to make it more affordable and accessible by reducing inappropriate care.

Now	Next	Beyond
COVID-19 has shown how rapidly and effectively data can be captured, shared and used, rather than fragmented across multiple organizations.	We will see a move toward more integrated and individualized data streams centered on the individual.	A hyper-personalized, patient-centered ecosystem, delivering affordable, accessible care, will emerge from the richer levels of collaboration and data-sharing between stakeholders.

Trend 2

With sensors in, on and around us, 5G and artificial intelligence will create a new network transforming health care.
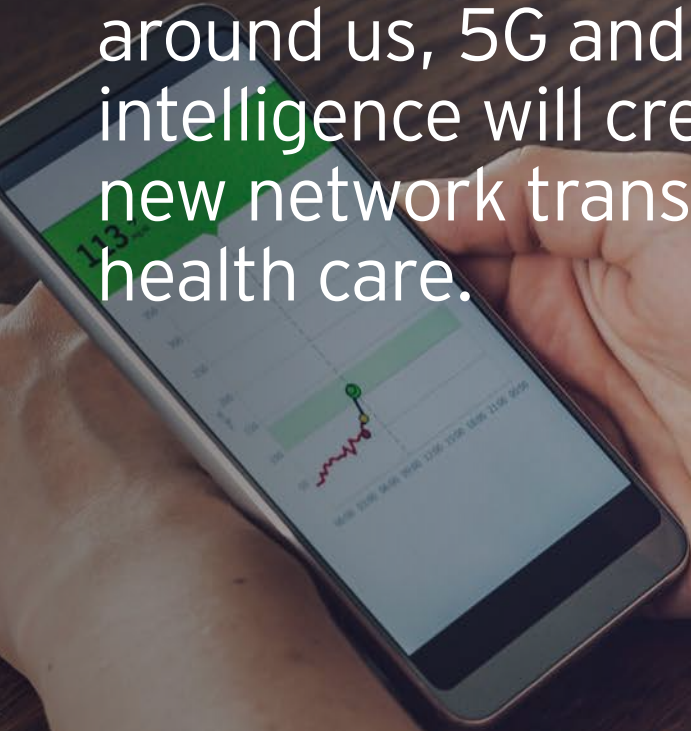
Technologies that will be critical for the future of health care have rapidly matured in recent years, especially sensors, fifth-generation wireless communications (5G) and artificial intelligence (AI). These technologies played a crucial role as the pandemic's spread accelerated: sensors tracked people's movements in order to monitor social distancing; 5G powered telehealth and virtual triage; while AI has been engaged throughout the crisis.

It was a Canadian AI startup, BlueDot, which detected the emergence of the pandemic nine days before the official WHO statement; subsequently, AI has been deployed to accelerate research into potential drug and vaccine development. These recent applications are only a preview of the radical potential the technology holds for health care.

Capable of being implemented at scale with minimal cost, sensors are already embedded throughout the environment and capture an ever-expanding range of new data. These real-time data streams can help generate insights that offer a more holistic picture of health. The emergence of 5G accelerates the transport of these data, while AI algorithms offer the analytical power needed to convert data into insights at high speed and scale.

In the past year, sensor innovations show the field's progress, from Valencell's earbud sensors for non-invasive blood pressure monitoring to Roche's Floodlight system, which deploys smartphone tools to track multiple sclerosis symptoms. These sensors expand the space in which health can be delivered, with patients now able to be monitored effectively anywhere and anytime.

The ongoing penetration of 5G networks will continue to make the capture of real-time data much faster and more robust. It will also allow these data to be analyzed and used with greater speed and confidence. There is immediate potential impact in acute home-based care, new community services and connected hospital devices.

The data generated and disseminated by these rising technologies will need equally powerful tools to organize, interpret and draw insights from them − and AI is critical in this journey. The rapid progress of AI is immediately visible if we consider the number of algorithms approved by the U.S. Food and Drug Administration (FDA) in 2018-19 (see Figure 4).

Figure 4: FDA approvals for AI algorithms
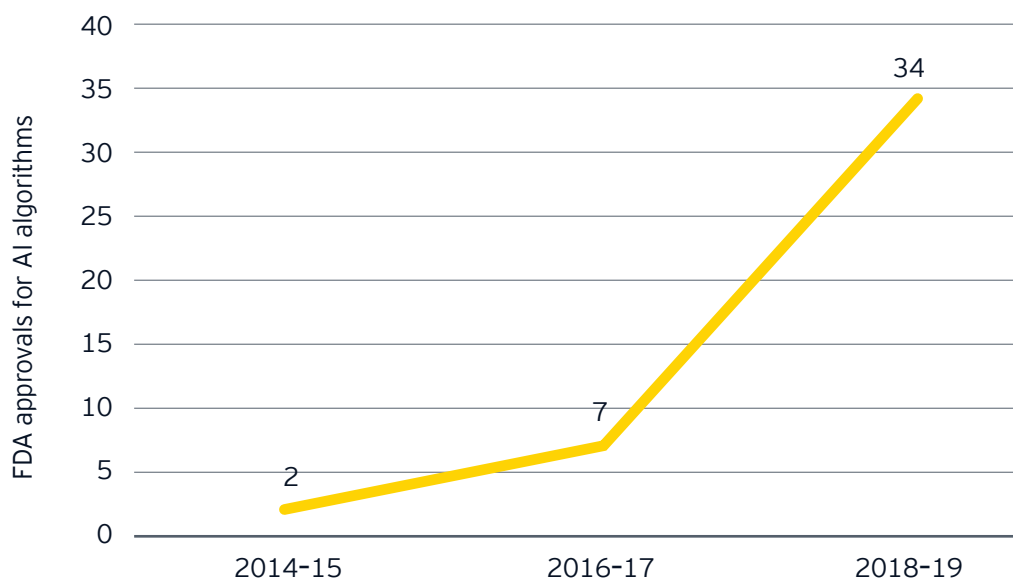
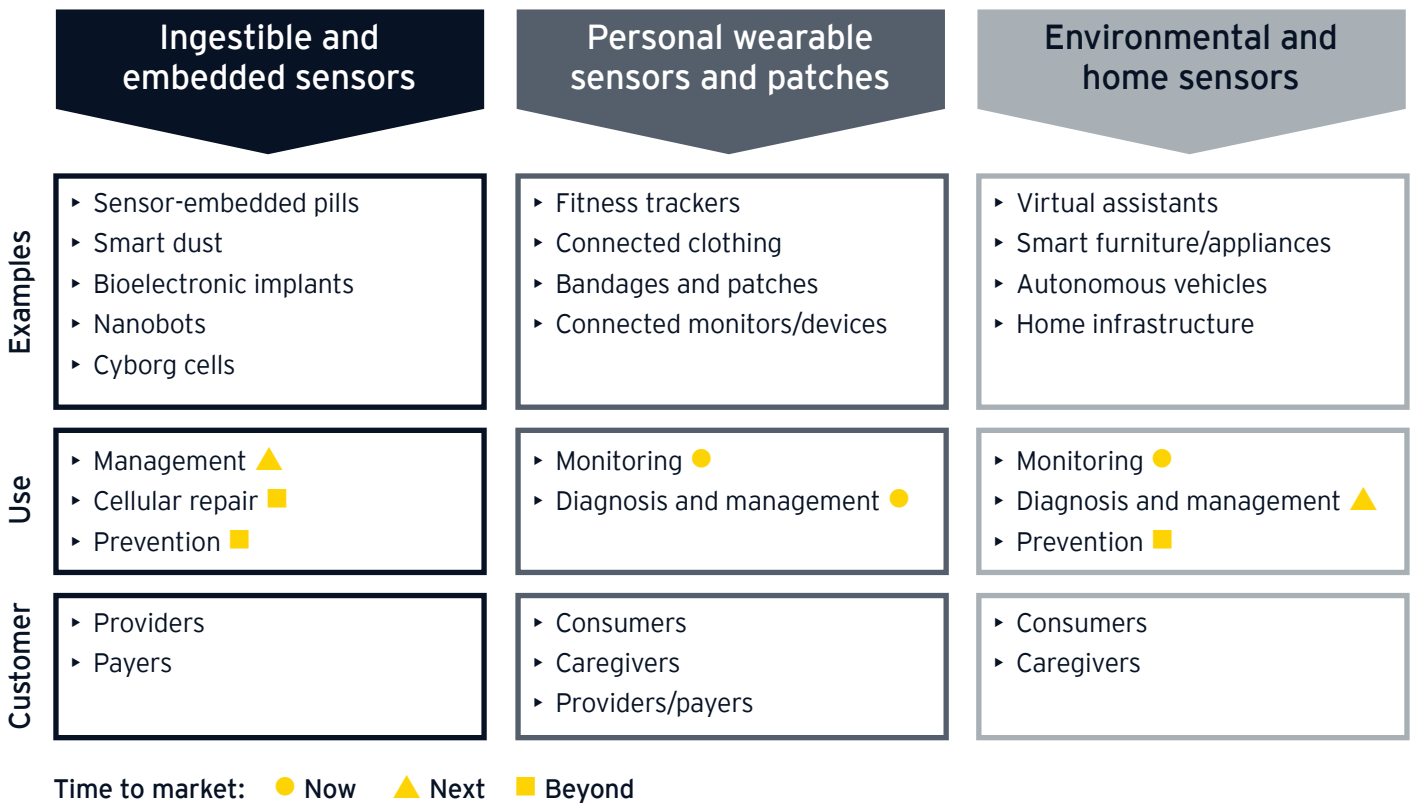Source: FDA; excludes AI software built into medical devices.

Indeed, this dramatic uptick in FDA-approved algorithms understates the situation, since AI is increasingly built into many other medical devices reaching the market. For example, the rise of new "artificial pancreas" device systems for diabetes (where a closed loop of blood-glucose monitoring and insulin delivery allows automated management of the patient's condition), demonstrates how applied machine learning is transforming medtech.

The new decade has already witnessed multiple AI successes, as companies harness the technology to monitor and manage cancer in addition to heart disease and diabetes. For example, OncoHost's proteomics-focused AI tool for personalizing cancer treatments was FDA approved in January 2020, while the startup 3Derm received two FDA Breakthrough Device designations, which will provide a quicker path to market for algorithms for autonomous AI skin cancer detection.

As impressive as these developments are, they are only the beginning. Sensors will move beyond the category of medical devices, becoming increasingly embedded throughout homes, vehicles and working environments. In addition, miniaturized implantable sensors will dynamically track the patient's biology in ever more detail, allowing proactive diagnosis, management and treatment of conditions (see Figure 5 and Figure 6).
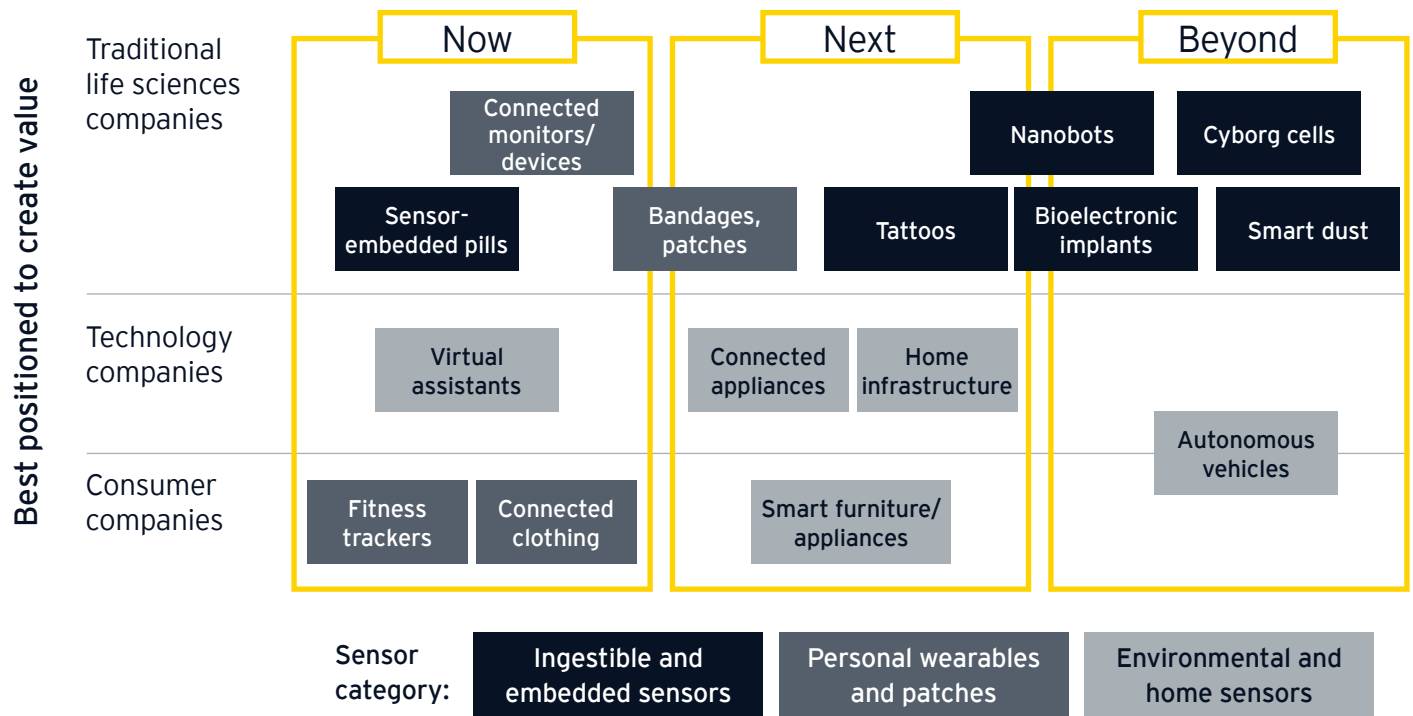
Rather than the traditional infrequent check-ups with a health professional, individuals will be constantly monitored via sensors capturing a comprehensive and continuous stream of data. As 5G usage spreads and AI evolves, these effective data-capturing capabilities will be matched by equally advanced systems for transmitting and interpreting data. Together, these technologies will form the basis of a powerful emerging new network that will form a key part of the future ecosystem for health care.

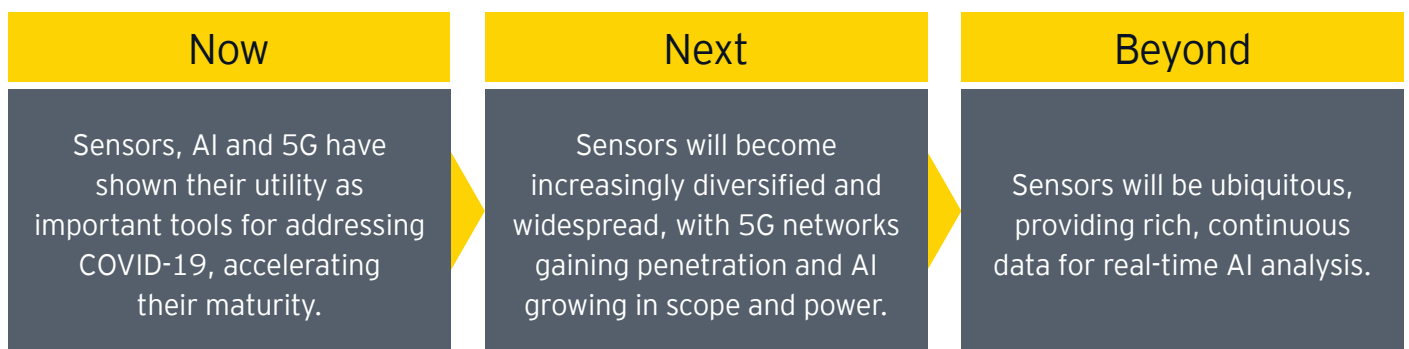## Figure 5: Health care sensors can be mapped into one of three categories

Ingestible and embedded sensors	Personal wearable sensors and patches	Environmental and home sensors
Examples		
‣ Sensor-embedded pills ‣ Smart dust ‣ Bioelectronic implants ‣ Nanobots ‣ Cyborg cells	‣ Fitness trackers ‣ Connected clothing ‣ Bandages and patches ‣ Connected monitors/devices	‣ Virtual assistants ‣ Smart furniture/appliances ‣ Autonomous vehicles ‣ Home infrastructure
Use		
‣ Management ▲ ‣ Cellular repair ■ ‣ Prevention ■	‣ Monitoring ● ‣ Diagnosis and management ●	‣ Monitoring ● ‣ Diagnosis and management ▲ ‣ Prevention ■
Customer		
‣ Providers ‣ Payers	‣ Consumers ‣ Caregivers ‣ Providers/payers	‣ Consumers ‣ Caregivers

Time to market: ● Now   ▲ Next   ■ Beyond

Source: EY.

Figure 6: Different industries are best placed to develop specific classes of new sensors

Best positioned to create value

	Now		Next		Beyond	
Traditional life sciences companies	Connected monitors/ devices				Nanobots	Cyborg cells
	Sensor-embedded pills	Bandages, patches	Tattoos	Bioelectronic implants	Smart dust	
Technology companies	Virtual assistants		Connected appliances	Home infrastructure		Autonomous vehicles
Consumer companies	Fitness trackers	Connected clothing	Smart furniture/ appliances			

Sensor category: **Ingestible and embedded sensors** | **Personal wearables and patches** | **Environmental and home sensors**

Source: EY.

To realize the potential of sensors, 5G and AI, organizations must:

▸ Collaborate outside the traditional health sector to extract and combine data from medical and non-medical sensors.

▸ Work alongside other stakeholders to help develop the AI-based solutions that can deliver hyper-personalization.

▸ Recognize and exploit the potential for anytime, anywhere care delivery enabled by the combination of these technologies.

Now	Next	Beyond
Sensors, AI and 5G have shown their utility as important tools for addressing COVID-19, accelerating their maturity.	Sensors will become increasingly diversified and widespread, with 5G networks gaining penetration and AI growing in scope and power.	Sensors will be ubiquitous, providing rich, continuous data for real-time AI analysis.

To personalize health, organizations must use data to understand and influence behavior.

The COVID-19 pandemic is bringing the challenges and the potential of behavioral change to the forefront of global health. Through social distancing and shelter-at-home policies, public health bodies rapidly created and promoted new norms for public behavior, as they sought to limit the virus' opportunity to spread by persuading individuals to, for example, wash their hands more frequently and thoroughly, and gather in groups less often and more cautiously.

Though efforts to use behavior change to benefit public health have been made at an unprecedented scale in 2020, the scientific consensus that behavior is critical to health outcomes is well-established. Indeed, behavior is generally recognized to be far more influential on health outcomes than medical care as traditionally defined (see Figure 7). It's now clear that to deliver better outcomes to individuals across the population, we must bring behavior and health care closer together. In doing so, we must create systems that not only make treatments more effective but drive lasting behavior change.

Consider an issue as basic as medication adherence – recent studies have suggested that in the US alone, non-optimized use of medicines incurs costs of more than US$500 billion annually (nearly one-sixth of all US health spending).[3] If behavior change can better address the huge clinical and financial costs of misused medicines it can be a powerful lever for easing the burden on payers, increasing access and affordability, boosting providers' ability to deliver care effectively and allowing life sciences companies to validate the effectiveness of their products.

This unmet need inspired efforts to create a "smart pill" that tracks adherence. Proteus Digital Health won FDA approval for the first such product in 2017. Yet, despite this breakthrough, Proteus has struggled subsequently, with big pharma partner Otsuka recently cutting investment.

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3   JH Watanabe, et al., "Cost of Prescription Drug-Related Morbidity and Mortality," *Annals of Pharmacotherapy*, September 2018.

Figure 7: Drivers of individual health outcomes

40%
Socioeconomic factors
‣ Education
‣ Employment status
‣ Family/social support
‣ Income
‣ Community safety

10%
Physical environment
‣ Location

30%
Health behaviors
‣ Tobacco use
‣ Diet
‣ Alcohol use
‣ Exercise
‣ Legal and illicit drug use

20%
Health care
‣ Access to care
‣ Quality of care
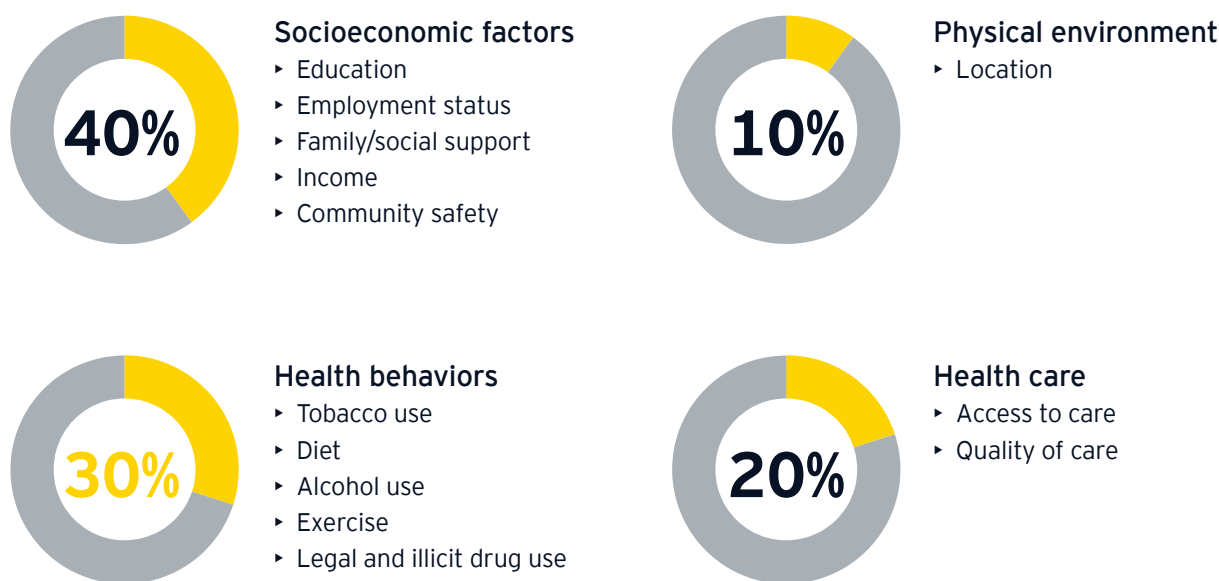
Source: "Health Policy Brief: The Relative Contribution of Multiple Determinants to Health Outcomes," Health Affairs, August 21, 2014; EY.

Future products and services need to be delivered within an influencing environment where sensors and AI can enable a continuous "judge and nudge" assessment of patient behavior and steer them toward better health.

Proteus is not alone in its struggles. The past year has seen repeated setbacks for the behavioral health field: the wellness startup Arivale folded, Novartis dropped out of promoting Pear Therapeutics' anti-addiction digital therapeutics and Sanofi stepped back from its Onduo diabetes startup as it reprioritized its R&D.

The high rate of setbacks for behavior change-focused startups isn't because the technologies themselves have failed. In fact, there is growing evidence showing that digitally driven behavior change can deliver impressive outcomes. Virta Health recently reported that a trial of its nutrition and behavior remote coaching program was effective at reversing type 2 diabetes. In the same field, Welldoc has shown that its BlueStar digital therapeutic can achieve hemoglobin A1C reductions superior to standard clinical care. Meanwhile, Lark Health, which uses AI behavior-change coaching for chronic disease management, reported positive data in 2019. Evidation, which carried out a COVID-19 tracking initiative in 2020, has also used its behavioral measurement tools to collaborate with Eli Lilly and Apple on Alzheimer's digital biomarkers.

The question is, how can organizations build on these individual achievements to make behavior change an effective, mainstream tool within the existing care paradigm? Arivale's CEO suggested that cultural issues have tended to hold back the field of behavior change, with Americans "so living in the moment" that the idea of investing effort now for the sake of future health isn't a priority. (In behavioral economics, the phenomenon is known as "delay discounting.") There are also structural problems: current incentives don't support businesses that require payment now to change behaviors that will reduce future disease costs.

Most importantly, though, behavior change needs to be treated not as a separate field within health sciences, but as an integral aspect of the way health care is personalized and managed. Future products and services need to be delivered within an influencing environment where sensors and AI can enable a continuous "judge and nudge" assessment of patient behavior and steer them toward better health. Ultimately, individuals can improve their own health and wellness if other stakeholders can construct the personalized behavioral technologies that will help them help themselves.

To use data to enable behavior change, organizations must:

‣ Collaborate to design new payment models that reward for better management of health and wellness.

‣ Incorporate behavioral science into the design of products and services.

‣ Work to build patient engagement with behavior change solutions.

Now	Next	Beyond
Behavioral science has been used worldwide to try to contain the COVID-19 threat, yet it has only marginal use in health care under normal circumstances.	Bigger datasets and more powerful AI feedback loops will allow organizations to offer a better mix of products and personalized services and behavioral solutions.	Behavioral feedback and steering will be embedded throughout the individual's environment, driving personalized strategies for optimized health outcomes.

A trusted intelligence system is needed to secure the participation of the patient-consumer and other stakeholders.

As the COVID-19 pandemic unfolds in real-time, researchers are responding by connecting with each other, combining their expertise and sharing tools and information to better respond to the crisis and accelerate the development of therapeutics and vaccines. Regulators are showing flexibility by allowing clinical trial protocol deviations, reducing manufacturing inspections and accelerating approvals for treatments.

The exceptional circumstances require stakeholders to adapt and work together to coordinate an effective response – and give a real-life glimpse of how, in the future, a more collaborative ecosystem might develop.

The challenge is how to maintain that level of collaboration and forge stakeholder trust absent the urgency of a global health threat. In a data-driven health care future, the will and ability to share data between stakeholders will be critical to success. Although, even if organizations are willing, practical challenges remain – for example, in the area of cybersecurity. To share data you need to trust the other party's data security, and cyber protection is currently a serious unmet need across the sector.

Since health data are valuable and often held across a wide range of vulnerable systems, they are regularly targeted via cyber attack. Across the US, 2019 was the second worst year in history for recorded health care data breaches, more than the total number of breaches recorded over the previous three years combined (see Figure 8).[4] Attacks on data have reportedly increased during the pandemic, highlighting the urgency of this problem.[5]

As connectivity becomes more central to health care, regulators are likely to take a strong stance on the need to secure data. At present, organizations can opt not to declare known vulnerabilities associated with connected technologies they bring to market. However, the FDA has

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4   More than 41 million health care records were exposed, stolen or disclosed without permission in 2019 – an increase of nearly 200% on the previous year, according to the U.S. Department of Health and Human Services' Office for Civil Rights Research Report of January 2020.

5   See, e.g., Davey Winder, ''Cyber Attacks Against Hospitals Have 'Significantly Increased' As Hackers Seek To Maximize Profits''. Forbes. April 8, 2020. https://www.forbes.com/sites/daveywinder/2020/04/08/cyber-attacks-against-hospitals-fighting-covid-19-confirmed-interpol-issues-purple-alert/#71c49ff658bc

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Figure 8: Trend in US health care data breaches since 2014
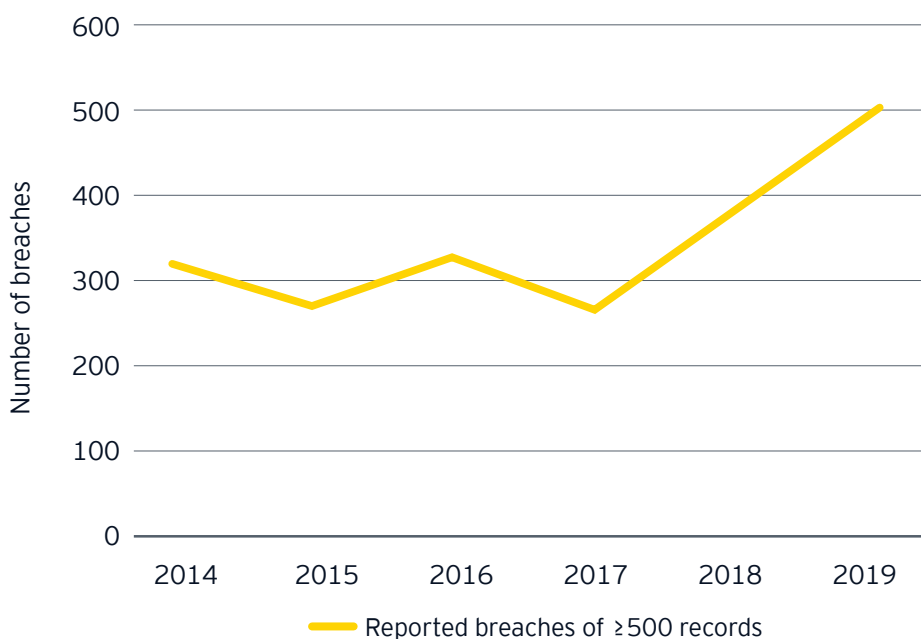
Source: U.S. Department of Health and Human Services' Office for Civil Rights Research Report, January 2020.

suggested this may change in the future. Organizations that want to maintain trust should move now to show that they're taking steps to secure their products and the data they generate and share.

Trusted organizations will be in a privileged position when it comes to developing the tools that will shape the post-COVID-19 health care world – for example, AI, which as mentioned in Trend 2, will be a key part of the future. At present, companies can develop AI for the market, but their products are "locked": after the AIs have been trained on defined data sets, the machine learning process is stopped. A marketed AI will stay as it is at the time of approval.

This makes AI manageable by traditional regulatory systems – if an algorithm continued to evolve post-approval it could rapidly result in a "new" product. But there is a trade-off: locking an algorithm limits its power, arresting it in an early state.

In 2019, the FDA issued guidance proposing a new approach to regulating AI. Instead of regulating algorithms, they will in effect regulate organizations, assessing company working practices, culture and expertise. "Trusted" companies will be permitted to launch unlocked algorithms and collaborate with the FDA on monitoring these products' performance "in the wild." A network of trusted collaborators will thus emerge to shape this "total product life cycle" (TPLC) approach to new technology.

The companies that thrive in this collaborative, trust-based environment will have a huge advantage – not only with regulators but also with their other stakeholders. They will be best placed to create the future "trusted intelligence" systems that will give the patient-consumer the secure, convenient tools to engage confidently with the broader ecosystem.

To build a trusted intelligence system, organizations must:

‣ Design products and solutions with a focus on generating data and securing it.

‣ Work proactively with regulators to create more robust and trustworthy frameworks for the exchange of data.

‣ Work with regulators to enable fully powered algorithms to reach the market.

Now	Next	Beyond
Trust and collaboration between stakeholders have been required to manage the COVID-19 pandemic, even as challenges remain.	There will be an increased drive to build the trusted systems that can enable better collaboration, with rising cybersecurity standards and more powerful, unlocked AI entering the market.	A secure, patient-centered ecosystem will develop, allowing permissioned data sharing and trusted intelligence interfaces.

Organizations must be decisive in the business model they choose to pursue in the future.

With the global economic impact of the COVID-19 pandemic, organizations are likely to face ever-tighter capital constraints. These constraints make it imperative that companies move toward more focused business models rather than spreading their efforts across a range of different approaches. Already, EY analysis shows that companies with a narrower therapeutic focus outperform companies with more diffused portfolios.

This trend to specialization will continue into the future, and EY has identified four critical business models (see Figure 9) that can deliver long-term viability for organizations in the health sciences and wellness space.

As the COVID-19 pandemic illustrates, each of these business models can play a critical and complementary role. Breakthrough innovators in the life sciences field have the expertise to rapidly develop the new pharmaceuticals, vaccines, diagnostics and other medical devices required to address emerging threats. Among provider groups, it's the breakthrough innovator organizations that have the state-of-the-art medical equipment and institutional know-how to help the individuals with the most severe conditions and highest risks.

At the same time, the crisis is also underlining the need for commodity equipment at scale, from basic drugs such as painkillers, to face masks and ventilators, to mobile hospitals. This is an area where efficient producers, specializing in rapid production, tight turnarounds and robust supply lines play the most critical role.

COVID-19 is also highlighting the urgent need for both virtual care and health maintenance, areas where disease and lifestyle managers excel. Patients with chronic conditions are at high risk from COVID-19 and need to self-isolate. But at the same time, they also still require high-touch care if their diseases are to be managed effectively. Disease managers play a critical role here. By closely tracking, monitoring, coaching and medicating patients as needed, these organizations can help supply the care for patients with diabetes, cardiovascular disease and respiratory conditions.

Telehealth is rapidly becoming the rule, not the exception, as patients maintain their distance from the bricks-and-mortar institutions and integrate care into their daily routines. Life sciences companies and health care organizations that choose to take up the challenge of becoming disease managers have an important role: creating customized products and services to help people manage their diseases themselves.

Meanwhile, it's increasingly obvious that self-isolated individuals need support to maintain their physical and mental health. As such, the pandemic is emphasizing the need for effective lifestyle managers that help individuals maintain their own health and wellness goals.

In the post-COVID-19 world, the challenges will change, but all of these business models will remain essential. Breakthrough innovators will develop new approaches to unmet medical needs, from cancer to dementia. Efficient producers will deliver the affordable but effective care needed worldwide, especially if health care costs increase dramatically as a result of COVID-19. Though the burden on health care systems will relent, physicians and health systems will still be capacity constrained. Disease managers and lifestyle managers will play fundamental roles in the ecosystem, especially by delivering care to individuals with chronic diseases.

For all organizations, the challenge post-COVID-19 will remain: To identify what business model they can best employ, and to acquire the data that will make them most effective in this area.

Figure 9: The four critical business models for the future

Breakthrough innovator

A business model to deliver best-in-class efficacy

Characteristics

Premium-priced products and services require proven gold-standard results to justify their high cost; new medical innovations are pushing prices ever higher.

Payment based on outcomes is an important trend in reimbursement worldwide; new innovations will necessarily accelerate the use of value-based payment.

Breakthroughs such as cell and gene therapies offer unprecedented personalization and curative potential but require outcomes data to justify their unique costs.

For providers, breakthrough innovation will mean focusing on high-end specialist care and gold-standard technologies to deliver this.

Products may include: cutting-edge modalities e.g., cell and gene therapies; specialist hospital equipment e.g., digital robotics platforms

Services may include: novel infrastructure to deliver new therapies; specialist inpatient treatments and high-end expert care

Customer base may include: predominantly wealthy individuals

Key data imperatives

Need data to validate product effectiveness and personalize and optimize outcomes

Data to validate product effectiveness	Data to personalize and optimize patient outcomes	Data to customize end-user interactions	Data to manage operational margins

Data needs may include: Outcomes data and other real-world evidence of efficacy; genomics and other systems biology data for personalization; behavioral data to drive adherence and raise efficacy.

Disease manager

A business model to deliver end-to-end continuum of care

Characteristics

Chronic disease is a major health care challenge worldwide; addressing it requires not just more product innovation, but more diversified tools for management.

New digital technologies mean patients can be monitored – and high-touch care delivered – remotely, with a focus on real-time responsiveness and personalization.

Interoperability is an important component of this challenge; optimizing care requires different devices and systems to coordinate around the individual's needs.

Disease management will mean more personalized care whether delivered by providers, life sciences companies or a coordinated network of both.

Products may include: a diversified mix of products, constantly reviewed and adjusted, to manage disease, control side-effects and maximize quality of life

Services may include: behavioral nudges; help renewing and collecting prescriptions; ongoing remote monitoring, coaching and advice

Customer base may include: predominantly wealthy individuals and institutional care systems

Key data imperatives

Need data to personalize and optimize patient outcomes and customize end-user interactions

Data to validate product effectiveness	Data to personalize and optimize patient outcomes	Data to customize end-user interactions	Data to manage operational margins

Data needs may include: Real-world clinical data to track status and feed back to disease management algorithms; behavioral data to drive efficacy; and lifestyle and environmental data to personalize care.

Source: EY

Lifestyle manager

A business model to deliver consumer-centric services

Characteristics

Many products and services already address holistic maintenance of lifestyle, health and wellness, from apps to consumer health products purchased OTC.

Lifestyle managers have the opportunity to personalize and refine these offerings, tailoring them to increase the ease, convenience and relevance of the user experience.

This model focuses not on disease, but on ongoing proactive management of health and wellness, treating the individual less as a patient and more as a wellness consumer.

Customer experience innovations in retail and other sectors highlights the potential for customized, data-driven platforms to personalize and optimize interactions.

Products may include: wellness apps tracking, e.g., diet and exercise; OTC products, e.g., nutraceuticals; basic fitness monitoring sensors and wearables

Services may include: timely delivery of products; prompts, reminders and recommendations; remotely delivered coaching and gamification

Customer base may include: predominantly mass-market consumers

Key data imperatives

Need data to customize end-user interactions, manage operational margins, personalize and optimize patient outcomes.

Data to validate product effectiveness	Data to personalize and optimize patient outcomes	Data to customize end-user interactions	Data to manage operational margins

Data needs may include: Data on consumer behavior, to customize the way the user finds, chooses and buys the products; lifestyle and basic health data to tailor recommendations and coaching.

Efficient producer

A business model to deliver commodity products better

Characteristics

The global need for affordable care options is demonstrated by the importance of products and services ranging from generic drugs to doc-in-a-box clinics.

Health delivery suffers from legacy structures with many intermediaries (e.g., GPOs, complex wholesale/retail chains) and lack of consumerization.

The high cost burden of health care worldwide (for insurers, health systems and patients) provides a strong incentive for companies to develop lower-cost options.

Amazon, UPS and others have revolutionized supply chain operations, but in health care the opportunity remains to build a business model for affordable delivery.

Products may include: affordable generic/similar versions of existing products; commodity medical devices

Services may include: basic clinical care and triage services; tools to increase convenience and ease of high-volume purchasing

Customer base may include: predominantly institutional health care systems

Key data imperatives

Need data to manage operational margins and validate product effectiveness, and customize end-user interactions

Data to validate product effectiveness	Data to personalize and optimize patient outcomes	Data to customize end-user interactions	Data to manage operational margins

Data needs may include: Data to optimize supply chain, internal operations; management of distribution, inventory and demand; customer knowledge to allow a more convenient consumer experience.

To future-proof their business models, organizations must:

‣ Identify and focus on their own core value to the broader ecosystem.

‣ Secure access to the right data, and in the right way to optimize and validate their own business model.

‣ Work to build the services and customer engagement expertise to deliver value more effectively.

Now	Next	Beyond
Most organizations' capital is currently deployed across multiple business models with limited specialization and inadequate data and services capabilities.	Organizations will continue to focus their business models based on the data-driven outcomes they can deliver for their target customers.	Organizations will optimize their role within the future operating system with a more efficient and flexible mix of data-driven products and services.
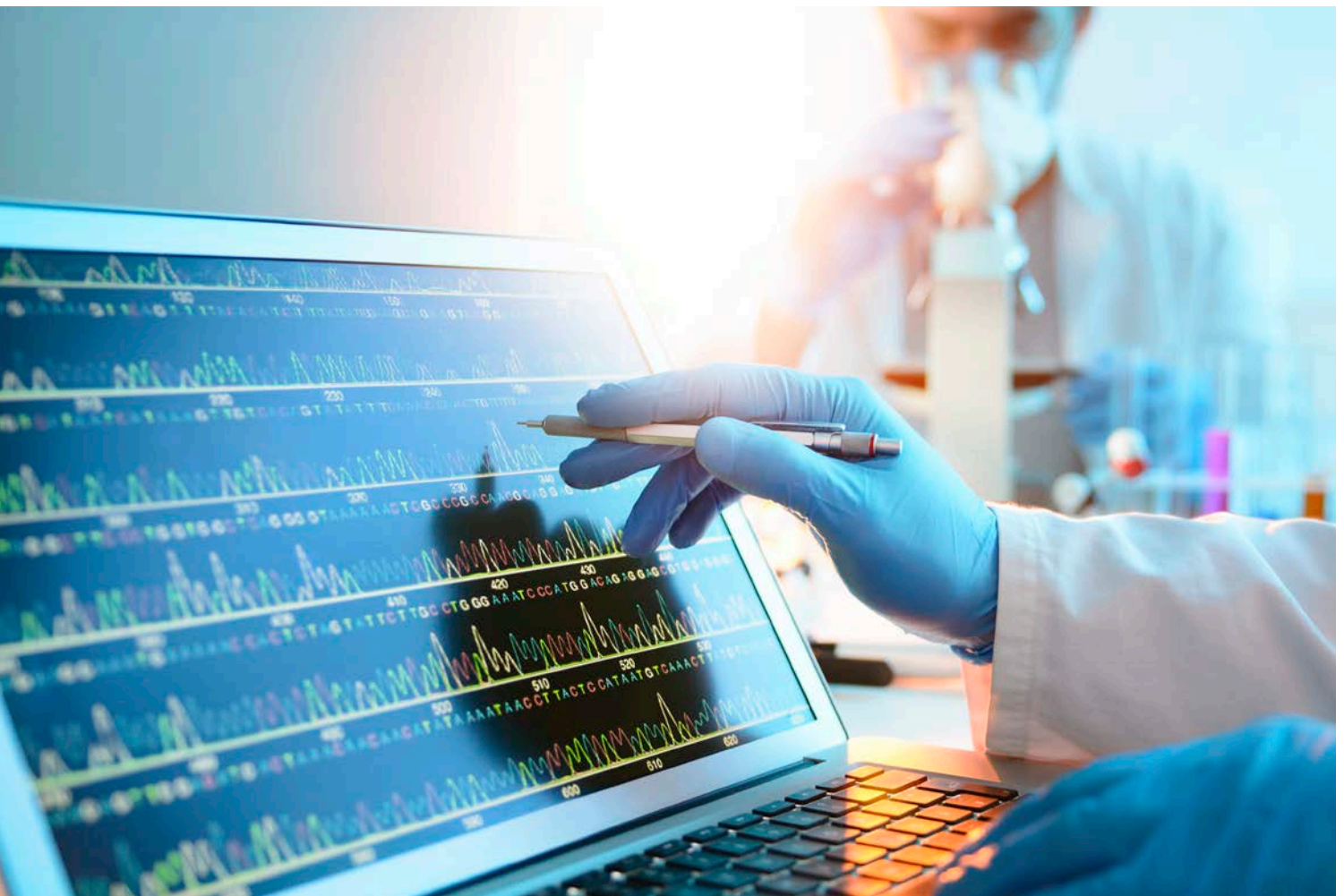
Conclusion

The 2020 COVID-19 pandemic is testing the global health care infrastructure and finding it wanting. By demonstrating how rapidly existing systems can be overwhelmed, the outbreak may lead to the recognition that health, like roads or buildings, is infrastructure worthy of significant, ongoing investment for future resilience.

To build that resilience, there is an urgent need to prioritize a health data agenda that allows businesses, health systems and individuals to anticipate and manage future challenges. Most serious among these challenges: the ongoing burden of chronic disease driven by an aging global population. Right now, organizations must rethink how they can create future value and enable personalized outcomes driven by the power of data (see Figure 10).

The specific components of this future ecosystem, as discussed in this paper, require much additional effort and investment. Stakeholders will only create integrated, interoperable sysems of care that are trusted and empowering for individuals if they are willing to abandon outdated notions of data ownership.

In the past, organizations have acknowledged the need to change their own behaviors, but have tended to defer action to the future. The unknown returns on investment relative to the upfront costs have limited organizations' willingness to commit resources. However, one of the main lessons of the COVID-19 crisis is the importance for health care players to act now in order to be ready for the future.

That future may look very different from the present — and the change may not be a gradual process. Technologies accelerating at exponential speed can be deceptively slow to show their true significance, yet cause sudden and major disruption as they mature (see Figure 11). Organizations need to be ready to rapidly adapt and change.

Figure 10: A new equation for delivering value in the health ecosystem

$$FV = I^D$$

Future value $= \left[\begin{array}{c} \text{Innovation} \\ \text{Outcomes x Personalization} \end{array} \right]$

Data
(Connect + Combine + Share)

For people
For physicians
For payers
For policy-makers

Participatory
Precise
Predictive
Proactive

Data streams

Traditional and non-traditional partners

Platforms of care
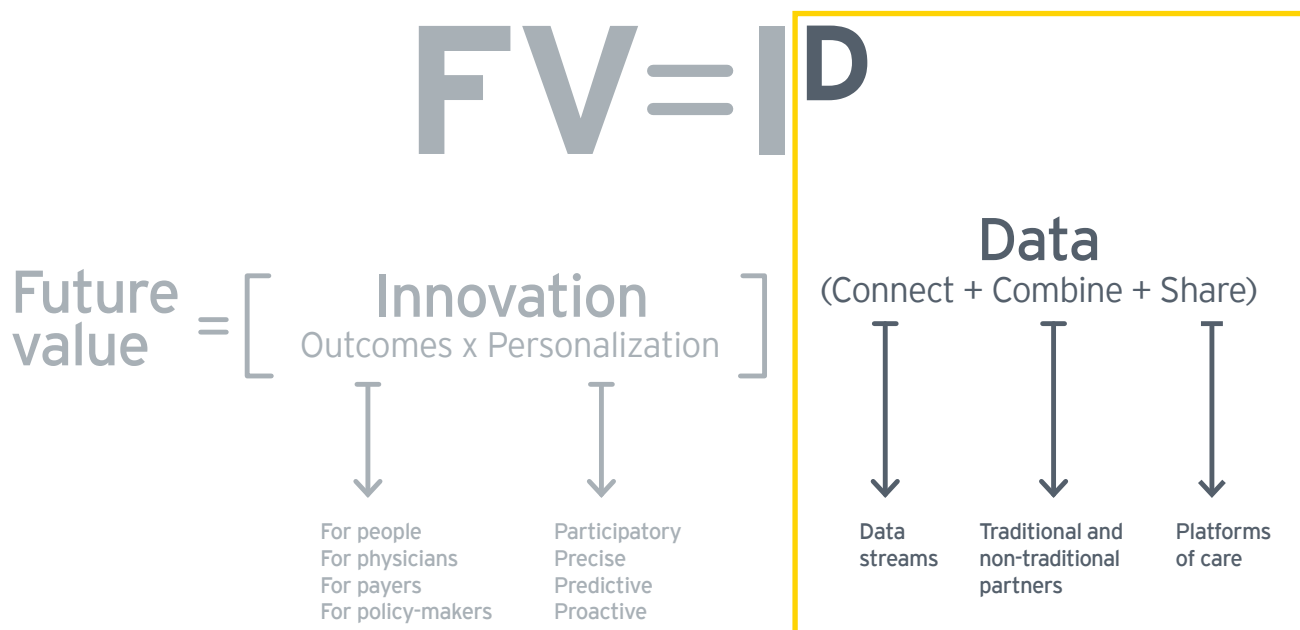
Source: EY.

As reported from the FORTUNE CEO Initiative, which convened more than 40 CEOs to discuss COVID-19 responses, the disruption caused by the pandemic has accelerated some of the changes that health care needs to see. In particular, companies forced into remote working models have realized that digital transformation is a current necessity.

More generally, the pandemic is changing the world in permanent ways. We won't return to the pre-COVID-19 days again. "The emergence from crisis shouldn't be thought of as a 'great restart,' but rather a 'great reset,'" as one CEO told FORTUNE.

The health sciences and wellness industry now has the opportunity to use that reset as a starting point for reimagining health care as a data-driven, personalized ecosystem fit for the future. The question is, which organizations are brave enough to seize the opportunity?

Figure 11: Exponential change can shatter expectations
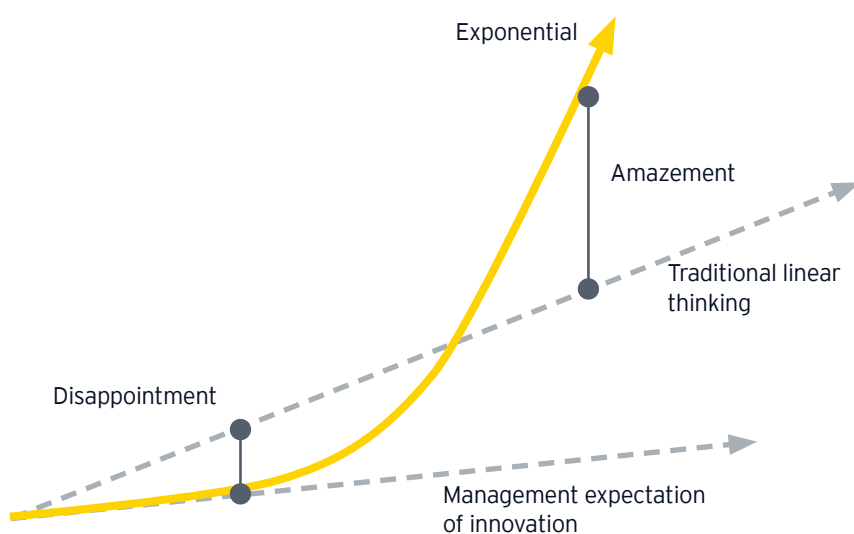
Source: EY

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