Deloitte.

The future awakens
Life sciences and health care
predictions 2022

November 2017

Contents

Deloitte Centre for Health Solutions

The Deloitte Centre for Health Solutions is the research arm of Deloitte LLP's Life Sciences and Health Care practices. Our goal is to identify emerging trends, challenges, opportunities and examples of good practice, based on primary and secondary research and rigorous analysis.

The Centre's team of researchers seeks to be a trusted source of relevant, timely and reliable insights that encourage collaboration across the health value chain, connecting the public and private sectors, health providers and purchasers, patients and suppliers. Our aim is to bring you unique perspectives to support you in the role you play in driving better health outcomes, sustaining a strong health economy and enhancing the reputation of our industry.

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Foreword

The year is 2022. The quantified self is alive and well, digital technologies have transformed the culture of health care and new entrants have disrupted delivery models. These are some of the predictions in our *Life sciences and health care Predictions 2022* report, which paints a picture of a health care world that is very different to the world in 2017.

As 2017 draws to a close, the future of health is more challenging and the possibilities more exciting than ever before. While the life sciences and health care industries are waking up to these possibilities, the need for strategies and judgement to shape our health – whether as a health care provider, life sciences company, clinician or patient – is also higher than ever.

Our report explores six predictions that build on our 2014 report *Healthcare and Life Sciences Predictions 2020: A bold future?* Some three years later, we have enjoyed numerous discussions and debates about our original predictions, and we have worked with many of our clients to consider the implications and how they might respond. Some of our predictions are already a reality, while others are still some way off. A few may never quite happen. Moreover, in the intervening years the pace and scale of innovation and, in particular, the impact of new science, automation and robotics on the future of work is becoming increasingly apparent.

This report evaluates evidence in 2017 and provides six new predictions of what the life sciences and health care industries might look like in 2022. We identify the major trends across the industries, the key constraints that will need to be overcome and the evidence available today to enable us to predict the future. We also identify case examples that illustrate the changing role of the patient and the importance of the patient experience, as well as how innovations and new business models are already transforming services, systems and processes.

Our six predictions once again present an optimistic view of the future, although we recognise that many in our industries are sceptical about the constraints and, therefore, the pace of change. We contend that being optimistic is necessary if we are to respond effectively to the health challenges emanating from a growing and ageing population and the tidal wave of chronic diseases that we face.

As always, we welcome any ideas or questions about subjects you would like us to explore further as part of our planned series of future-focussed reports.

Karen Taylor
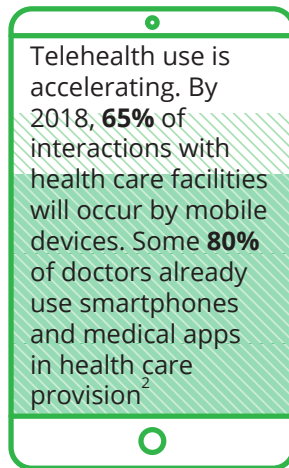Director
Deloitte Centre for Health Solutions

**Hanno Ronte**
Partner
Monitor Deloitte

Trends in life sciences and health care

Demographic trends

Average life expectancy in OECD countries has **increased by 5.5 years** from **75 in 1990** to **80.5 years in 2015**[1]

Telehealth use is accelerating. By 2018, **65%** of interactions with health care facilities will occur by mobile devices. Some **80%** of doctors already use smartphones and medical apps in health care provision[2]

In 1990, over **11 million** children died before age 5 compared to fewer than **6 million** in 2016. About **60%** of child deaths are from diseases that we can prevent with vaccines[3]
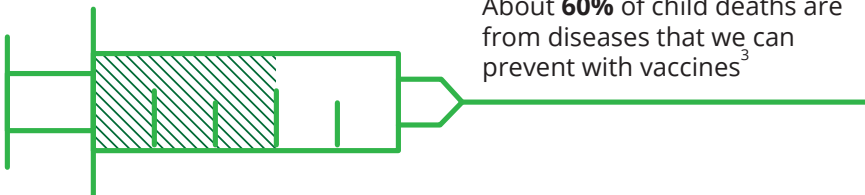
By 2020, the **over 65s** will number some **604 million – 11%** of the global population (**19.8%** of Europeans)[4]
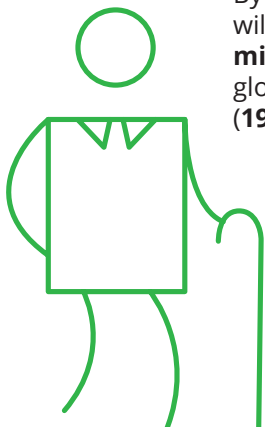
Economic trends

Global health care spending is estimated to grow at **4.2 per cent per year** from **$7.1 trillion in 2015** to **$8.7 trillion by 2020**[5]

Global pharmaceutical spending will rise by **5% a year from 2017-2021**, more than twice the average annual **2.2% rise during 2011 to 2016**[6]

MedTech sales are expected to increase by 5.1% from **$369 billion in 2015** to **$529.8 billion in 2022**[7]

In vitro diagnostics is one of the fastest-growing segments of MedTech and is expected to reach **$67.3 billion by 2020**[8]

The **orphan drug** market is projected to double to **$209 billion in 2022**, from **$102** billion in 2015[9]
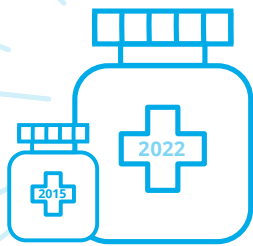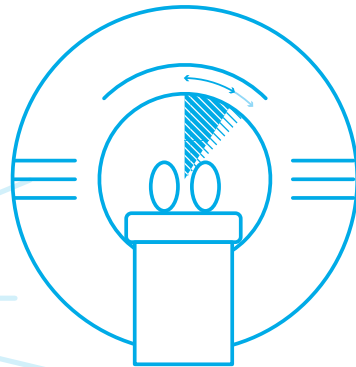

The market for **precision medicine** is expected to increase from $39 billion in 2015 to reach **$87.7 billion** by 2023[10]

Between 2010 and 2016 the average cost of bringing a drug to market increased by **33%**, yet average peak sales decreased by **49%**[12]

Oncology spending will grow at **9–12% each year until 2021**[11]

Preventive medicine - **DNA sequencing of genes** -is a new growth area anticipated to propel growth for biotech drugs at a CAGR of **9.7%** to reach **$144.8 billion** by 2020[13]

Global revenue from population health management software and services is projected to increase from **$8.92 billion in 2016** to **$50.35 billion in 2025**[14]

Disease trends
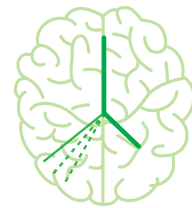
Someone develops **dementia** every **3 seconds**. In 2017, an estimated 50 million people worldwide live with dementia – a number expected to almost double every 20 years.[15] By 2018, the global cost of dementia will rise above a $1 trillion[16]

In 2014, obesity **cost $2 trillion** (2.8% of global GDP).[17] By 2025 **1.17 billion** adults will be affected by obesity[18]

The number of people with **diabetes** globally is **415 million**, which is expected to rise to **642 million by 2040**. The cost of treating diabetes globally is over **$673 billion a year**[19]

The percentage of deaths from **communicable diseases** is projected to **decline** from **22.5% in 2015 to 17.1% in 2030** while the percentage of **non-communicable** diseases may **increase** from **68.4% to 73.9%** , during the same time period[20]

2022

The quantified self is alive and well

The genome generation is more informed and engaged in managing their own health

Prediction In 2022, individuals are better informed about their genetic profile, the diseases they have or might develop, and the effectiveness of health interventions. They are more engaged in improving their own health, and their expectations of health care for themselves and their loved ones are high. The 'quantified self' has embraced prevention and is devoting time, energy and money to staying healthy, including using regulated and validated health apps and wearables. When ill, patients demand specific treatments and are also willing, in part, to pay. Patients are true consumers; they understand they have options and use information and data about themselves and providers to get the best treatment at a time, place and cost convenient to them. Wearables now operate silently, but powerfully, in the background. They are proactive and pre-emptive, rather than simply a monitor. The adoption of technology and reablement services are keeping people connected and active and helping to reduce the cost of health care.

The world in 2022

- The quantified self means people are active participants in managing their own health and wellbeing.
- There is now broad adoption of bio-sensing wearable devices (interoperable, integrated, engaging and outcomes-focussed) - the technology has become much cheaper and more sophisticated, and the quality of data has improved.
- New generation wearables continuously monitor a broad range of physiology, with service users supported to use the data to improve prevention.
- Wearables and connected devices are helping seniors age in place, alleviating, to an extent, the growing care gap.
- Interactive 'health app libraries' help people choose the most appropriate health apps and digital technologies and signpost individuals to a suite of approved digital health engagement tools.
- Voice technology is widely adopted, as people become more comfortable with secure, voice-based authentication services.
- Older people and those with dependencies are supported by virtual assistants to live more independently.
- Most people now expect to be offered telemedicine services, and many prefer first contact with a physician to be via telemedicine.
- People share their health data willingly with health providers, much like consumer data.
- Gamification, using a system of incentives and rewards, helps influence healthier behaviours.
- Patient groups have formed digital networks to support each other in managing their health, sharing best practices and lowering medical costs by tapping into the knowledge of the crowd.

Conquered constraints

- People accept that they are largely responsible for their own health; incentives for good behaviour are now firmly established – from reductions in co-payments to tax incentives (e.g. for not smoking).
- Payers and providers have created more patient-centric care delivery models that involve increased collaboration and shared decision making.
- People can access real-time information about the performance and outcomes of providers, including how personal information is used and protected, improving trust.
- Payers and providers have developed reliable risk mitigation strategies that demonstrate the effective use, and prevent misuse, of personal information.
- Health apps and digital technologies are 'kite-marked' to demonstrate they meet global compliance standards.
- Regulators have been instrumental in supporting the use of telemedicine technology based on new, reliable digital tools, including medications management, with most payers offering a menu of reimbursement options and/or tariff payments.
- Clarity over the role of insurance companies and how they can use data has reduced concerns over data sharing, albeit a 'healthy' level of distrust remains.

Note: All elements on this page are Deloitte's view of the world in 2022

Imagining the world in 2022

What if urban planners could capitalise on the quantified self movement?

In response to the rise of the quantified self, town planners have put good health at the centre of urban design and planning, aimed at tackling health inequalities. Initiatives include sprinting tracks marked out on pavements and cycling tracks on roads and protected green spaces, creating 'Healthy Towns'. More than half of the world's population now lives in cities. Many have become 'Smart Cities', taking a 360˚ view of how technology can improve operations and connect with citizens, businesses, and non-profits in new ways. Smart cities focus on improving outcomes through technology and are leading the way in public health initiatives, from calorie-count laws to the creation of ultra-low emissions zones. Planning authorities now incorporate health into all planning and development activities, responding to differences in climate, culture, resources and political conditions. Local governments everywhere are playing a greater role – from action on smoking and trans fats, to calorie content on packaging and introduction of soda taxes – helping to reduce obesity levels and improve health outcomes.

The 2022 patient portrait: How new generation devices and weight management services are helping to reduce diabetes risk

Mary has suffered from insulin dependent type 2 diabetes for 20 years and was not very good at managing her condition. However, in 2017 she was kitted with a smart device to monitor and adjust her blood sugar, combining a subdermal glucose sensor with an insulin pump. The device connects to her smartphone and feeds data into her electronic health record, which is also visible to her GP, who provides regular feedback via text messages on Mary's data. This transformed Mary's ability to manage her condition and significantly improved her treatment adherence. Unfortunately, the earlier mismanagement of her condition means her eyesight is poor, and she has a chronic heart condition that curtails her activity. Mary was worried about her daughter, Sophie, who had gained significant weight and appeared to be at risk of developing diabetes. Mary convinced Sophie to take a genetic test confirming her genetic disposition to type 2 diabetes. Knowing her biological risk encouraged Sophie to join an online weight management service endorsed by her mother's online diabetes control network. At the end of an eight-week medically supervised diet, Sophie had achieved her target weight. Sophie uses a wearable to record her activity, calorie intake and vital signs and shares her progress with her digital support network. Mary and Sophie have also joined a local gym and regularly attend personalised exercise classes. When they cannot make it to the gym, they use an online personal trainer, as part of a gamification programme endorsed through their insurance company.
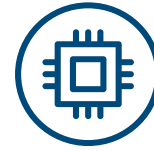
Pharma and the quantified self: Providing personalised health care via a network of specialist clinics

Since 2018, a leading pharmaceutical company has been operating a network of virtual clinics to support patients with serious bowel conditions. Services include genomic testing to establish any genetic causes of the bowel problems and innovative use of advanced digital technologies to track and monitor changes in the patient's condition. For example, an ingestible pill can monitor medication adherence and the patient's response to the medication in real-time. The pill dissolves in the patient's stomach, leaving a tiny sensor behind. The sensor, activated by fluids in the body, sends a signal to a patch on the side of the stomach measuring heart rate and other vital signs, and details of medication detection. A smartphone links to the patch, registers the information and sends it to the clinic, where clinicians proactively intervene if needed. Patients are much more informed about their condition and engaged in helping to improve their health outcomes. Doctors at the clinic organise virtual patient group meetings to help reassure patients about the use of the technology and 'buddy' them with patients with similar conditions. The clinics also use 'camera pills' (in disposable capsules) instead of traditional invasive methods to track the health of patients' gut microbiome. In 2022, an evaluation of patient satisfaction and patient outcomes rated the network above average compared to other more traditional health care provider services.
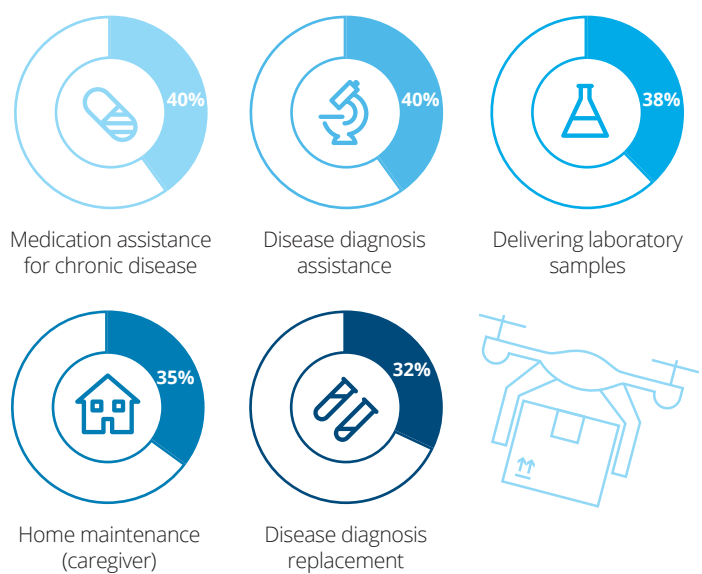
Evidence in (2017)

The rise of the quantified self

Differentiating the requirements of different types of consumers

In the US, 75% of consumers in 2016 sought a partnership with their providers to determine the most effective treatment decisions. Respondents generally reported not using, or understanding, the digital health care tools and resources available to them, and ranked these types of interactions as significantly less important than any other type of interaction. However, differentiating the requirements of millennials, who have used digital technologies for a majority of their lives, versus seniors, could help providers to develop specific strategies and digital tools for each consumer group. Consumers' top preference is having a doctor or other health care provider spend sufficient time with them and not rush through examinations. The most attuned clinicians use digital tools to capture and record discussions that free them to increase the amount of time they spend with their patients. One in three consumers also wants their clinicians to push them to be more active in relation to their prescribed treatments.[21]
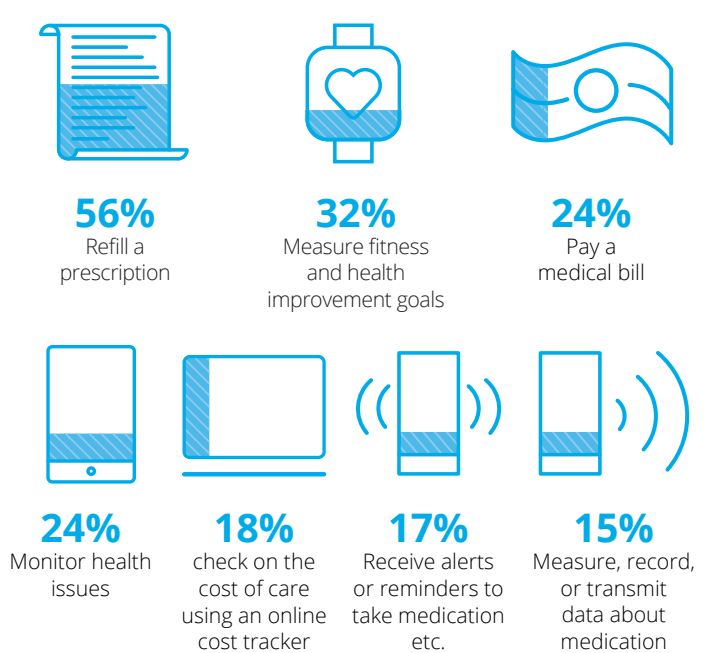
Biometric data sharing between doctors and patients

Sensors fitted to a disposable and adhesive patch can now be placed on the chest to monitor both acute and chronic diseases. Biometric data and disease signs are wirelessly sent and monitored by doctors and patients via Bluetooth technology. New research from Acuity Market Intelligence found that nearly two-thirds of smartphones shipped worldwide in 2017 will feature biometric capability. It also estimates that all smartphones worldwide will ship with biometric technology embedded in them by 2019.[22]

OurPath

OurPath is a 6-week, digital behavioural change programme that helps people sustainably improve their health and wellbeing. It links to digital scales, provides scales and provides personal mentoring, advice, education and coaching with scientific-based evidence of weight loss, increased energy, improved mood, better sleeping patterns, greater wellbeing and even diabetes self-management.[23]

Four in ten consumers are interested in using drones for medication assistance and robots for disease diagnosis assistance

Consumers are using health and fitness technologies to:

40% — Medication assistance for chronic disease

40% — Disease diagnosis assistance

38% — Delivering laboratory samples

35% — Home maintenance (caregiver)

32% — Disease diagnosis replacement

56% Refill a prescription

32% Measure fitness and health improvement goals

24% Pay a medical bill

24% Monitor health issues

18% check on the cost of care using an online cost tracker

17% Receive alerts or reminders to take medication etc.

15% Measure, record, or transmit data about medication

Note: Chart shows respondents who are likely to use the technology, where "likely" is defined as answering "4" or "5" on a five-point scale in which "1" is "not at all likely" and 5 is "extremely likely." Source: Deloitte research, 2016[24]

The use of digital technology

Wearables have become less of a novelty, with industry researchers agreeing that wearables are now in the commercialisation phase. While some practical challenges remain, including ease of use, standards, privacy and cost, the interest among health care providers, industry and consumers is growing.

In 2017 smartphone penetration reached[25]:

Rates have increased steadily since 2012, when only 52% of UK adults owned a smartphone[26]

81%
in the UK

77%
in the US

44%
worldwide

In 2016, app publishers launched **100,000 new health apps** bringing the total number available to consumers to **259,000**[27]

Only **24% of health apps** registered more than **50,000 downloads**[28]

Health app market revenue is projected to grow to **$26 billion** at the end of 2017[29]

Health app publishers derive **69% of their income** from services[30]

The global market for wearable medical devices and remote patient monitoring systems is expected to reach **$612 billion** in 2022[31]

Source: Deloitte

2022

The culture in health care is transformed by digital technologies

Smart health care is delivering more cost-effective, patient-centred care

Prediction By 2022, demographic and economic changes, increased patient expectations and advanced digital and cognitive technologies have disrupted health care worldwide. A growing number of inpatient health care services are now delivered more effectively at home or in outpatient ambulatory facilities. Patients with complex and acute inpatient needs are treated in smart digitally-enabled hospitals. Clinical roles have been optimised, and staff use cognitive technologies to deliver more seamless, integrated care designed around patient needs. Providers have established a data-driven, real-time understanding of patient flows and acuity to inform workforce planning. Patients control access to their health data, granting access to their electronic health records (EHRs) to all health providers, as and when needed. The digital hospital leverages technologies to optimise care delivery, patient experience, staff deployment and the management of back-office services, reducing costs and improving outcomes.

The world in 2022

- Robotic Process Automation (RPA) and Artificial Intelligence (AI) initiate and coordinate concurrent activities, including resolving nursing workflow pain points, allowing caregivers to spend more time providing care and less time documenting.
- Secretarial robots listen to consultations and write up notes automatically.
- Comprehensive software platforms support multiple modes of health care communication (voice calls, secure text messages, alarm and alert notifications), improving the efficiency and safety of caregiver communication.
- Clinical decision-making is enabled by centralised digital command centres.
- The design of the hospital supports the wellbeing of patients and staff, emphasising the experience of care.
- Digital supply chains, automation, robotics, and next-generation interoperability drive the productivity of most back-office functions.
- AI algorithms have changed disease diagnosis through mining medical records, reading imaging diagnostic tests and augmenting the role of radiologists.
- Biotelemetry monitors patients in their own homes, providing objective insights to clinicians and helping individuals understand their own vital signs.
- Online portals enable regulatory-compliant video interactions between the patient and clinician.
- E-visits are supported by portable point-of-care diagnostic tools, facilitating remote physical examinations, improving access and reducing travelling, waiting times and inconvenience.
- Radio-frequency identification (RFID) technology tracks staff and equipment, helping to optimise the use of resources.

Conquered constraints

- Hospitals have established a culture for digital transformation, with senior managers promoting the importance of a digital future and driving its implementation at all levels, including providing staff with the requisite skills needed to optimise the use of technology.
- Clinician satisfaction with EHR systems has improved significantly due to a new generation of apps that integrate effectively into the workflow, delivering efficient clinical decision.
- New international governance standards on interoperability have helped mitigate cyber risks, despite the proliferation of medical-grade digital devices.
- Blockchain technology has enabled development of an accessible, comprehensive, secure, and interoperable repository of health information.
- Network connectivity, including access to fast, secure Wi-Fi, is widely available, enabling patient records and point-of-care diagnostics to be accessed as and where needed.
- Telemedicine and telementoring have regulatory approval and clinician support.
- New funding models enable payers to commission for outcomes for a defined patient population from vertically integrated accountable care organisations.
- The silos between hospital and community care have been eroded by designing care pathways around the patient, supported by interoperable EHRs; hospital staff run community clinics, and primary care staff provide inreach services and co-ordinate home care.

Note: All elements on this page are Deloitte's view of the world in 2022

Imagining the world in 2022

What if a tech giant becomes the public's provider of choice for health care?

Back in 2018, TechA built an RPA and AI discharge planning 'bot' to initiate and coordinate concurrent health care activities, including the hospital discharge summary, prescribing, transportation, referrals to home support services and the scheduling of follow-up visits. Two years later, TechA acquired a small chain of digital acute hospitals across Europe, and by 2022 was firmly established as a health care provider of choice. TechA has also developed a set of virtual, interactive post-registration professional training modules that have been approved by the appropriate regulators, with modules aimed at both newly qualified and seasoned clinicians. This virtual training has helped make specialist expertise available across a larger audience and geography, with measurable improvements in quality of outcomes and costs savings.

A patient portrait in 2022: How smart technology is revolutionising knee replacement surgery

Jon was recently admitted to hospital for a 3-D printed knee replacement. During pre-admission, the hospital provided Jon with a supervised, app-based exercise regime to help with recovery. During a pre-op visit with the surgeon, Jon was guided through an immersive virtual reality experience of the 3-D procedure. The hospital app also provided instructions and a map to help the admission process. After logging onto the admissions robot, Jon was guided to his room, where his television console welcomed him and provided him with details of his expected patient journey. With AI built into his secure, cloud-based health EHR, Jon could confirm answers to any further questions he had about his care. Throughout his stay, his wrist band, provided upon admission, monitored his vital signs remotely, alerting caregivers to any significant patterns. It also houses a secure payment app to purchase hospital services. His hospital records were automatically populated through digital uploads, voice-capture sensors, and information from caregivers. Most of the routine charting and orders were entered through RPA and supported by AI. Following his discharge, Jon's physio managed his rehabilitation remotely using a sensor-device connected to an interactive mobile app that works in concert to guide Jon through his daily exercise routine, as well as collecting patient-related outcomes information, which automatically syncs with his EHR.
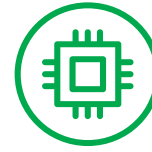
A digital hospital in 2022: How a smart hospital is transforming productivity and the patient experience

In May 2018, the country's first fully digital, government-funded hospital opened, aimed at elevating the patient experience through digital technologies. These technologies help patients throughout the care process – from pre-admission to post-discharge. All clinicians can access secure, integrated EHRs on their own devices, including information on the patient's condition, medical history and details of all allergies and medications, including primary care details. Diagnostic and lab tests are ordered directly from the clinicians' devices, and results are automatically captured by the EHR, including photos snapped by smartphones. Clinicians receive real-time notifications. All patients and treatments are monitored via RFID technology, providing a closed loop medication cycle, which automatically syncs with his EHR. The EHR automatically determines if patients are candidates for new treatments or clinical research that might improve their outcomes. The hospital uses robots via an underground tunnel to deliver medications, transport blood samples, collect diagnostic results and schedule linen and food deliveries, generating considerable cost and time efficiencies and improving reliability. Robots sterilise surgical tools, reducing infections, and dispense drugs in pharmacies with zero errors. All patients have bedside consoles that provide education, entertainment, and social media services, along with pertinent medical information. Post-discharge, patients can schedule outpatient appointments through a personal device.Virtual assistants help people navigate the hospital, and avatars provide patients with education, guidance and counseling. Prescribing is based on centrally written drug dispensing algorithms.

Evidence in (2017)

The advent of smart health care

Virtual rehabilitation in orthopaedics

Physical therapy is a critical part of orthopaedic care. As the era of value-based care and bundled payments takes hold, there has been be an expansion in the availability of new sensor-devices connected to a mobile app that can guide patients through their daily exercise routine following orthopaedic surgery, recording range-of-motion, which is key to better clinical outcomes. The data is also shared in real-time so clinicians can tweak exercise protocols and guide patients through exercises. The system collects patient-reported outcomes to support reimbursement for orthopaedic procedures such as joint replacements.[32]

Mercy Virtual Care Center: No waiting rooms, hospital beds or patients on site

Mercy Virtual Care Center, which opened in autumn 2015, is part of a $300 million investment over a decade-long journey. The 125,000-square-foot facility with no waiting rooms, hospital beds or patients, houses more than 300 medical professionals on site, as well as another 300 team members off site, who monitor computer displays, caring for patients at 40-plus hospitals in seven states in the U.S. In addition to intensivists who observe patients and direct care at distant ICUs, neurologists provide guidance on stroke treatment to community hospitals. A team of virtual hospitalists orders and reads tests, and nurses field questions about everything from nosebleeds to sinus infections. Other clinicians stay in near-continuous touch with chronically ill patients at home. As Mercy continues to integrate virtual care in all aspects of the patient experience, Mercy expects to see more of these types of results, which include a 35% decrease in patients' average length of stay and 30% fewer deaths than anticipated. In 2017, Mercy expects 1,300 ICU patients who otherwise would have been expected to die to return home, saving more than $50 million in health care costs.

Technology-enabled diagnosis of chronic conditions

Smartphones and tablets are helping nurses to diagnose patients with chronic health problems such as obesity, smoking and depression (in both adults and children). Using customized questions, they encourage users to follow clinically supported guidelines, develop care plans and make treatment decisions. Obesity diagnosis rates from nurses using the clinical decision support system outpaced nurses who are not using the system (33.9 per cent versus 4.8 per cent), with similar results for tobacco use (11.9 per cent versus 2.3 per cent). With the guideline system, 44 times more adult depression was diagnosed than without the system and four times more paediatric depression.[34]

Patients Know Best: A patient-controlled health care record system

Patients Know Best (PKB) is the world's first patient-controlled health care record system. Patients can see their full medical record from all primary, secondary, tertiary and social care providers. The patients add their own data into the same medical record, including manually entered symptoms and automatically transferred data from over 100 wearables and devices. Patients share and discuss their record with clinicians (and researchers if the patient agrees). The patient-controlled architecture allows shared care planning and integra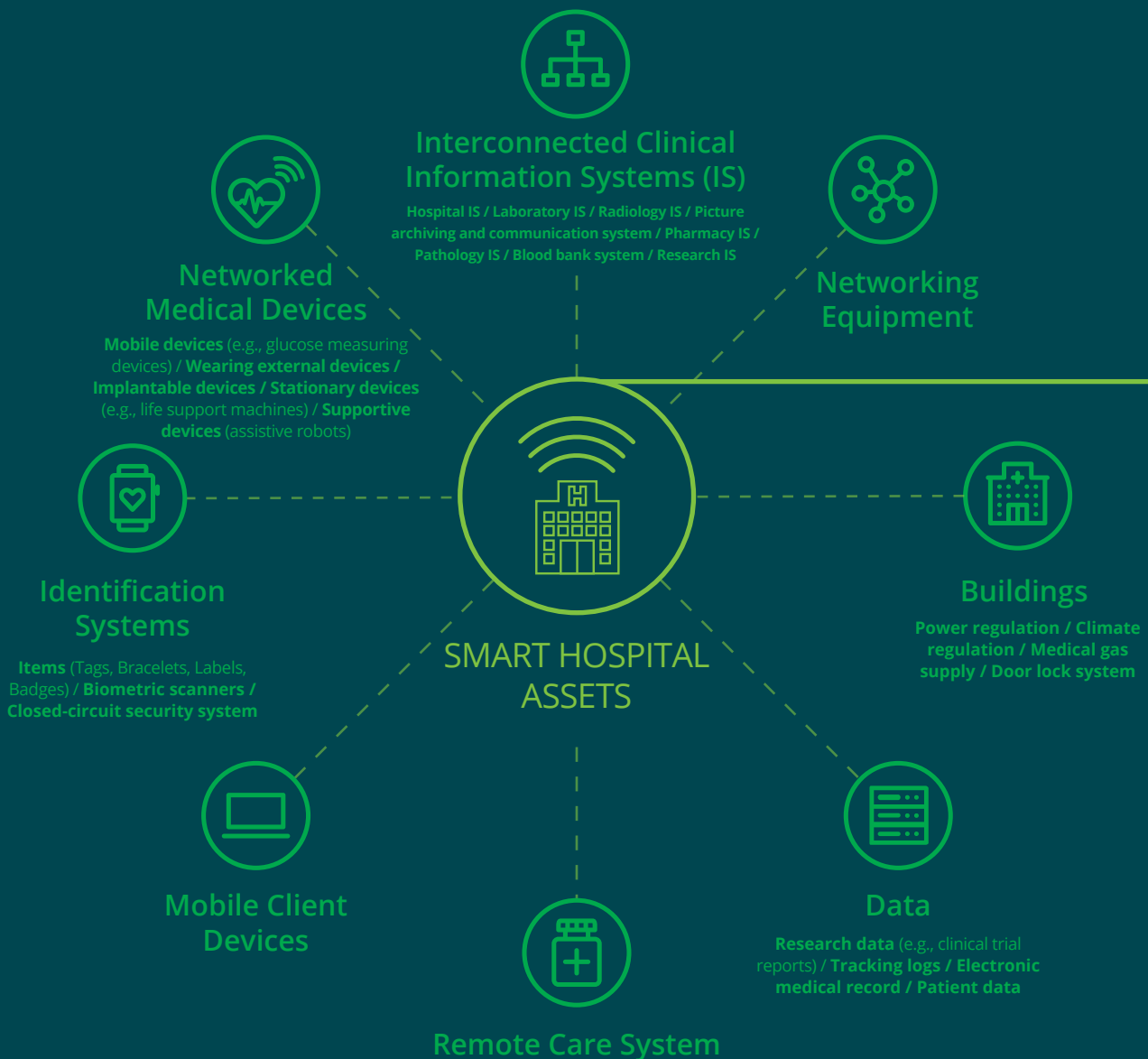ted health care delivery across all providers, unlike the care plans and records in institutional electronic health records and institutional patient portals. PKB integrates fully into any health records system, including the UK's NHS secure network, and is available for use by patients and clinicians worldwide in 19 different languages. [35]

Growth of population health management

Population health management (PHM) is being implemented in several high-income countries, with the objective of reducing health care costs by reducing the burden of chronic diseases and increasing support for preventive health care. The market for PHM software and services is projected to grow to over $50.35 billion by 2025, up from $8.92 billion in 2016.[36]

The rise of smart hospitals

HIMSS Analytics has developed an Electronic Medical Records Adoption Model (EMRAM), which has been measuring the adoption and utilisation of Health IT since 2005. It comprises eight stages ranging from 0 (very limited digitalisation) to 7 (paperless). Stage 7 hospitals use hospital-wide IT systems to manage the entire continuum of care and can demonstrate significant, sustainable improvement in patient outcomes and financial returns. In 2017, the US had 334 Stage 7 hospitals, with 70 per cent of hospitals Stage 5 or above. In Europe, some 2,500 hospitals had been assessed at the end of 2016, but only four were awarded Stage 7, with around 50 at Stage 6. Working digitally (particularly Stages 6 and 7) facilitates innovation and helps boost patient participation via wearables and self-monitoring tools, enabling them to access their patient data from home.[37]

Interconnected Clinical Information Systems (IS)

Hospital IS / Laboratory IS / Radiology IS / Picture archiving and communication system / Pharmacy IS / Pathology IS / Blood bank system / Research IS

Networked Medical Devices

Mobile devices (e.g., glucose measuring devices) / **Wearing external devices / Implantable devices / Stationary devices** (e.g., life support machines) / **Supportive devices** (assistive robots)

Networking Equipment

Identification Systems

Items (Tags, Bracelets, Labels, Badges) / **Biometric scanners / Closed-circuit security system**

SMART HOSPITAL ASSETS

Buildings

Power regulation / Climate regulation / Medical gas supply / Door lock system

Mobile Client Devices

Remote Care System

Data

Research data (e.g., clinical trial reports) / **Tracking logs / Electronic medical record / Patient data**

Source: The European Union Agency for Network and Information Security (ENISA), 2016 [38]

2022

The life sciences industry is industrialised

Advanced cognitive technologies have improved the productivity, speed and compliance of core processes

Prediction In 2022, pharma uses a lean operating model to generate funding for R&D and deliver more cost-effective medical innovations. The 'industrialisation' of pharma has led to predictable productivity increases across its functions and geographies. Companies have moved through three phases of evolution – first codifying and standardising processes, then automating them, and now deploying AI and machine learning to increase the pace and productivity further still. The traditional focus of industrialising finance and operations has been extended to a transformation focused on improving productivity across compliance, commercial, development and discovery. This step change improvement in productivity has improved compliance and enhanced predictability of core processes. The companies with the best track records in industrialisation are driving sector consolidation, leading to some 30 per cent reduction in development cycle times and 40 per cent improvement in productivity.

The world in 2022

- Investigator-less clinical trials – with large academic centres replaced by local clinics, remote monitoring, digital biomarkers, and home visits – have led to significant cost reduction and the generation of more meaningful data through continuous monitoring.

- Real-world evidence (RWE), including historic mining of data, is used to identify and enrol patients in clinical trials, and provides the control arm for large scale trials.

- A greater focus on personalised medicines has required increased automation of batch processes, replacing scale development and manufacturing.

- Automated writing of clinical study reports using natural language processing has industrialised the conversion of structured study data into text narratives.

- Leading companies have automated up to 95% of regulatory filing, saving around 12 months in the launch cycle time.

- Product launch factories have standardised launch preparation and created predictive analytics for market research, improving the consistency and impact of product launches.

- Commercial marketing processes utilise global, central repositories of data via digital platforms, with AI used to drive more responsive marketing segmentation.

- Data scientists and programmers are the new 'heroes' in pharma. Most employees are more digitally savvy, with multidisciplinary skills and talent, and Chief Information/Digital Officers are members of the executive management team.

- Companies have enhanced their supply chain management with digital tools, predictive analytics and more accurate tracking techniques, ensuring that all transactions are accurately recorded and easily shared.

Note: All elements on this page are Deloitte's view of the world in 2022

Conquered constraints

- Common technical standards have been established across the globe to ensure product quality, reduce redundant manufacturing plant inspections and help companies manage increasingly long supply chains.

- Companies operate more like software organisations focused on managing and analysing data to create value.

- Companies that forged international partnerships with academia, as part of their STEM talent development strategies, have bridged the life sciences talent gap; they have also adopted a well-defined 'employer value proposition' (EVP) to aid recruitment and retention.

- Regulatory processes have been addressed, with clarity for digital interventions and pre-certification.

- Pharma companies have adopted cloud-based systems that talk to each other and enable interoperability of data system linkages to regulators.

- Digitising the supply chain has delivered significantly improved outcomes, with digital supply networks using machine learning and additive manufacturing to provide data flow and analytics, enabling connectedness and electronic tracking.

- New technologies such as blockchain are enabling safe and secure data linkages, revolutionising privacy and data security both internally and externally.

- Consent architectures and clarification of Information Governance (IG) regulations have helped patient engagement, improved reimbursement, accelerated development/launch and lowered the cost of research and development.

Imagining the world in 2022

### What if pharma became more like a global commerce company?

Customers are provided with complete visibility as to how their order is being processed and when it is scheduled for delivery. Such transparency and speed have been made possible thanks to an interconnected platform utilising electronic commerce and cloud computing that actions data collected and analysed from across the supply chain. The life sciences industry has long recognised the importance of data and has worked hard to put it to optimal use, overcoming the problem of data warehouse silos, and making it easier to access and derive insights. The acquisition of a leading pharma company by a global internet retailer has enabled data from different functions across the supply chain, including external stakeholders, to be combined, analysed, and presented in 'dashboards' that issue alerts when there are stock-outs or risks, such as changing of weather conditions or unavailability of certain raw materials. Companies also deploy data analytics and cloud computing to gain visibility and take preventive action, based on data from multiple sources in order to understand and predict risks and events before they become issues. Logistics automation has created an industrialised supply chain delivered directly to the patient using robots and drones, fundamentally changing the role of pharmacies and wholesalers.

A portrait of two pharma employees whose jobs have been reshuffled around automation

Like many other industries, the acceleration of connectivity and cognitive technology has changed the nature of work in pharma. Most jobs have been reinvented, and new jobs have been created, while others have been automated. With hindsight it was easier to predict which jobs were going to be lost and harder to predict which would be created. For example:

- Anna works in the newly created Digital Commercial Marketing Centre. For key brands, much of multichannel marketing has been taken 'above country'. Anna is based in Prague, in the European Commercial Customer Hub – a newly established centre that manages all the digital communications with physicians. Each communication is tailored to the physician and links into the reports from the key account managers on the ground. Anna checks automated prescriptions generating the next wave of interactions and monitors the error log of the email bot that responds to physician enquiries. Anna's job is to check, judge and lead the ideas for the next wave – something AI cannot do.

- Meanwhile, automation and predictive analytics based on the previous 12 months of data has enabled Marcus in supply chain to predict demand within three per cent, almost eliminating inventory. Moreover, the automation of the supply chain from plant to patient is the foundation for medical studies on adherence. Smart packaging records when the pill is taken out of the pack, and the patient's phone marks the supply chain as complete. Marcus now ensures that the linkage to the EHR system is robust and that the medical team can use the anonymised patient data for the study it requested last month on adherence.
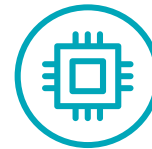
New software tools are driving productivity improvements in regulatory and reimbursement filing

The trial database was locked, and the automated software tools went to work. Rather than the traditional weeks of effort, and based on the Target Product Profile, a draft regulatory filing appeared in Petra's email in a matter of hours. Petra's regulatory role is now focused on checking rather than writing. At the same time, Alex from Market Access has adopted the Market Access Dossier (MAD) tool. Using the tool, Alex configures parameters such as standard of care and key product differentiators – taken from the regulatory filing – and builds standardised paragraphs that allow affiliates to automatically translate and drop them into the local reimbursement reports.

Evidence in (**2017**)

The impact of increased use of robotics and automation

Transforming talent acquisition strategies

In response to global demand for top talent, life sciences leaders are transforming their talent acquisition strategies, selecting partners, piloting technologies and customising new recruitment and retention strategies.[42]

Realising savings from automation

A digital supply network connects manufacturers with suppliers by, for example, having the kits tagged with RFIDs, which can be tracked by a hospital's smart cabinets. As soon as the kit or parts of it are removed, the hospital is billed, and the inventory replenishment process starts even before the other kit has been shipped back. That way, the companies are potentially able to lower consigned inventory by about 25 per cent and reduce their excess and obsolete inventory by more than 50 per cent.[39]

Personalisation using 3D printing

Thanks to technologies such as additive manufacturing (also known as 3D printing), medical devices – dental or knee implants, for example – are best 'made to order' based on specific patient geometry, thus improving outcomes. The potential for medical outcomes from the personalised approach is reflected in the sector's growth projections.[44] The US global personalised medicine market is forecast to reach $2.4 trillion through 2022 at a compound annual growth rate (CAGR) of 11.8 percent—more than double the projected 5.2 percent annual growth for the overall health care sector.[45]

Optimising marketing processes

One large pharma company built a centralised marketing support system creating a central hub for research to avoid duplication of research questionnaires, duplicative research agencies and protocols and eliminated duplication in detail aides. This optimisation of marketing processes and operations resulted in annual savings of between 15-20 per cent.[46]

Digital 'always-on' supply chains

A host of potentially disruptive technologies are creating digital 'always-on' supply chains that will provide better efficiency, visibility, and customer service across a variety of industries, while challenging companies to find the talent to manage them, according to a new study by MHI and Deloitte that is now in its third year.[41]

Migrating data to 'the cloud'

"Celgene, which manufactures drug therapies for cancer and inflammatory disorders, worked with Deloitte to achieve a 99 percent savings in process run times for Real World Patient data analysis and a 70 percent reduction in operating costs by migrating legacy workloads via Cloudera Enterprise."- Cloudera Data Impact Awards[43]
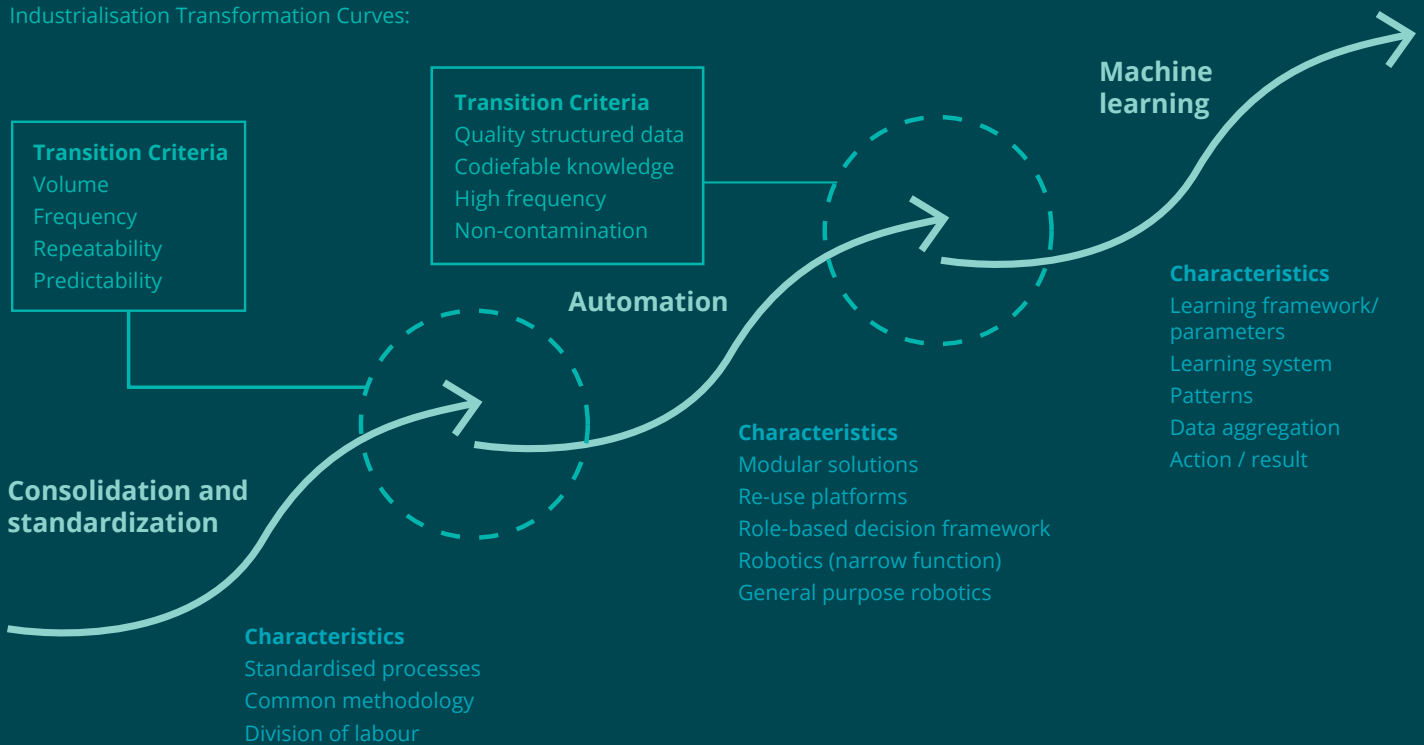
Automating the drug discovery process

Many pharma companies are investing in partnerships with AI developers in order to automate the drug discovery process. These partnerships aid in selecting, assessing and designing new molecules who have the ability to meet the desired drug development criteria, helping to increase efficiency in R&D.[40]

The industrialisation of life sciences

Three phases of industrialisation are transforming the productivity in knowledge-based organisations

Industrialisation Transformation Curves:

Machine learning

Transition Criteria
Quality structured data
Codiefable knowledge
High frequency
Non-contamination

Transition Criteria
Volume
Frequency
Repeatability
Predictability

Automation

Characteristics
Learning framework/
parameters
Learning system
Patterns
Data aggregation
Action / result

Consolidation and standardization

Characteristics
Modular solutions
Re-use platforms
Role-based decision framework
Robotics (narrow function)
General purpose robotics

Characteristics
Standardised processes
Common methodology
Division of labour

The contract in a day: Improving productivity via Enabled Contracting Solutions (ECS)

Purpose

Deliver a 'Contract in a Day'

Enhance collaboration between process stakeholders i.e. contract teams, legal & study team

Simplified process for development partners (sites and CROs)

Visibility and transparency on contract status, process performance and study costs

Impact

Solution is live in the US and 7 other markets

Approx. 40% reduction in effort to execute a contract (time on task)

1-10 days to execute a contract down from >8 weeks

Digitisation will allow analysis of costs, enable procedure based payment and provide performance data

Project to improve clinical contract cycle time and to enhance relationships with investigational sites

2022

Data is the new health care currency

Artificial Intelligence and real-world evidence are unlocking value in health data

Prediction In 2022, health care data is a national infrastructure priority and critical business asset, attracting significant funding. Real-world data (RWD) is providing the information needed to enable researchers to develop more precision medicine and clinicians to predict patients' response to treatments. Clinical guidelines and experiences have been turned into computer algorithms to support clinicians and payers to find optimal treatments. Clinicians have better information about their patients' genetic profile, their stage of disease, and the treatments available for their condition. As more traditional clinical and financial datasets are joined by data generated by the Internet of Things (IoT), patient-reported outcomes, and a wealth of new genomic, transcriptomic, proteomic, microbiome and epigenomic data sources, have enabled the industry to paint extraordinarily detailed portraits of individuals and populations. Clinicians and health care officials use health and social care data to transform diagnosis and treatment, improving outcomes and health care productivity. Pharmaceutical companies now collaborate fully with patients and health care systems, using data to develop better treatments, launch them faster and price them according to improvements in health outcomes.

The world in 2022

- All stakeholders now accept that the patient owns their own data, and patients readily give consent for their health and social care data to be used.
- Health data is delivering financial and clinical success, enabling predictive analytics, real-time clinical decision support, precision medicine, and proactive population health management, driven largely by rapid advances in machine learning.
- Health care systems are capitalising on the value of data sources and data is monetised for the benefit of all.
- Providers have formed data partnerships to transform care based on precise real-world insights.
- Doctors and other clinicians have improved the digital IQ and skills in analytics.
- Pharma companies have built, bought and hired data scientists, developed actuarial capabilities and have established partnerships to use data and analytics across the value chain.
- Online patient communities have grown exponentially, providing rich crowd-sourced data, with rating systems for products, services and providers.
- Advanced analytics are applied to social media to provide an understanding of treatment outcomes, allow real-time tailoring of treatment messages and services, and provide early alerts on disease outbreaks.
- Trials for small patient groups are now routinely designed and accepted using historic RWD as a control arm.
- Consumers' engagement with their data has led to better medication adherence and management of chronic disease, providing a clear return on investment for providers.

Note: All elements on this page are Deloitte's view of the world in 2022

Conquered constraints

- Silos and roadblocks across health care organisations that prevented effective data-sharing have been addressed by clearly protecting the privacy and security of patient data , including through the use of blockchain.
- Governments, academia and businesses have collaborated to build 'data lakes' within a strong cyber ecosystem, including national funding for IT and health data infrastructure and deploying technologies such as blockchain.
- Tax and legal implications of data ownership and sharing have been clarified through new legislation.
- The use of data in regulatory decision-making by the Food and Drug Administration (FDA) and the European Medicines Agency (EMA) has been clarified, covering 'big data' topics, such as social media and mobile health data, genomics and other 'omics' data, and clinical trial data, including data from imaging datasets, observations and adverse drug reactions.
- The introduction in 2017 of HL7 Fast Healthcare Interoperability Resource (FHIR), the internet-based data exchange standard, has helped health care organisations solve many of their most pressing data problems, paving the way for more integrated workflow, detailed clinical decision support, and patient engagement.
- Tighter connections between health and social services have improved collaboration, including access to data on the wider social determinants of health.

# Imagining the world in 2022

What if a tech giant launched a health care company?

The tech giant's investment in developing a wide range of innovative health technologies and its numerous partnerships with health care providers has help democratise health care to a large degree. Its role in providing immediate access to real-time information about the role and performance of numerous stakeholders has been particularly successful. In 2016, it began investing in cutting edge technology around the development of automation and robotics and in exploring the boundaries of science to help tackle obesity and ageing. By 2022, innovations such as a pill that detects cancer, a map of all the biomarkers in the human body and a new CRISPR-based (Clustered Regularly Interspaced Short Palindromic Repeats) gene-editing platform were helping scientists from around the globe. Therefore, it was no surprise it crossed its own self-imposed boundary in 2022 and, building on its experience in using data and developing miniaturised medical devices, launched a first-of-a-kind, data-led, integrated, accountable care system. This capitalised on learning from its earlier launch of a health insurance subsidiary, which by 2022 was dominating the industry by matching every uninsured person to a customised plan.

A portrait of a doctor in 2022

Dr Paul runs a thriving outpatient clinic and primary care centre that includes telehealth services for his patients with chronic conditions outpatient. About five years ago, recognising the benefits of placing more emphasis on data science to get the most out of advanced analytics and machine learning, he formed a partnership with a new breed of 'clinical decision making' companies. This enabled him to predict the risk of deadly illness like stroke and cardiac disease in his patient pool and pre-emptively reach out to specific patients. Dr Paul realised that if his practice was to make the most of data and cognitive computing, other members of his medical team needed access to new skills such as analytics and computer science to "systematically analyse every heartbeat". Nowadays, he regularly runs professional development sessions to help his staff improve their digital IQ. Digital skills and literacy in data analytics, data management and assessment quickly became a core function of their job. In addition to realising the benefits of data and algorithms in assisting diagnosis, he uses a 'pathway analyser' to monitor medication adherence and deploys digital delivery mechanisms, such as digital pill boxes, pills with built-in sensors, and virtual digital assistants to enable his team to keep an accurate track of whether patients are sticking to their treatment plan. Last month, Dr Paul completed a two-year initiative to sequence the genome of relevant patients to screen for the BRCA gene for breast and ovarian cancer risk.
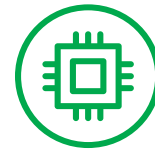
How blockchain has transformed a pharma company's enterprise-wide operations

A pharma company that adopted blockchain across their entire R&D enterprise has helped to improve the integrity and transparency of clinical trials by providing assurance that clinical trials data has not been tampered with, and that any deviations from the clinical trial protocol is available for all to see. Using such a system has helped meet the requirement that all clinical trials should be recorded and published on a publicly-accessible database, while preventing data manipulation practices that could undermine the integrity of published research. The process is cost-effective and automated, with the company and its academic partners taking advantage of blockchain-based clinical trials. Blockchain has also brought innovation into tackling the problem of counterfeit medicines entering the supply chain, which has long been a challenge for the company. The use of blockchain has stopped sub-standard medicines reaching patients. In providing a trusted record of the provenance of drugs, the company can say with confidence where a specific packet of medicines has come from, further increasing patient confidence in the pharma industry.

Evidence in (**2017**)

Use cases for data analytics and genomics

DeepMind Health is establishing strict rules to improve the safety and security of health data

DeepMind Health (DMH) has two strands of work: processing data for the provision of direct care on behalf of NHS trusts to deliver a clinical app for patient deterioration alerts and results viewing called Streams; and a separate set of AI research projects using de-personalised data and carried out in partnership with clinicians,

which will examine whether AI techniques can help speed up diagnosis and treatment. When processing patient data for direct care, the partner NHS Trusts are the 'data controllers' and decide what can and cannot be done with the data. DeepMind Health has established strict rules around keeping data safe, including

adopting world-leading standards of security and encryption. NHS patient data is fully encrypted and stored in a high-security facility in England, separated at all times from any other systems. Only those who need to access the data are able to, and all data is deleted entirely from the systems when it is no longer being worked on.

All data use is logged, and can be reviewed by NHS partners, regulators, and a panel of 'Independent Reviewers'. DMH is developing a 'Verifiable Data Audit' tool, which will give partner hospitals a real-time mechanism to check how data is being processed, when a piece of data has been used and for what purpose.[49]

Using data insights to help control the spiralling costs of health care

IoT is a reality, creating vast amounts of data faster and more detailed than ever before (the world's data volume is expected to grow by 40 per cent a year).[47] Meanwhile health care costs are spiralling out of control, with global health spending projected to rise by 4.2 per cent per year from $7.1 trillion in 2015 to $8.7 trillion by 2020, something that is becoming increasingly unsustainable for most countries. If health care is to remain affordable and widely available for future generations, a rethink of how it's provided and managed is crucial.[48]

The Broad Institute of MIT and Harvard and its Genomics Platform is providing scientists with access to genomic data

The Broad Institute of MIT and Harvard and its Genomics Platform provide comprehensive genomic services, including sample handling, genotyping, gene expression analysis, and genome sequencing to the scientific community. It:

- pioneered continuous improvement of massively parallel sequencing

- drives technology innovation by improving processes, inventing applications, and creating rigorous quality measures

- is responsible for the development and dissemination of tools and methods for data analysis, such as the Genome Analysis Toolkit (GATK), an open-source software package for processing and analysing

sequencing data. GATK was released under an open source software license. The GATK-based workflow for variant detection has over 45,000 academic and commercial users worldwide and has been run more than 800 million times by users outside of the Broad Institute

- deploys wide scale adoption of re-engineering/lean process management tools across the genomics platform.

Over the past five years, the Broad Institute has been the largest producer of human genomic information in the world, producing genomic data at a rate of one 30X human whole genome every 12 minutes. The group has processed more than 1.5 million samples from more than 1400 groups in over 50 countries.[50]

Artificial intelligence is being used to improve diagnostics and determine appropriate therapies

AI systems are now being deployed in medicine to help pharmaceutical companies prevent drug–drug interactions and to help clinicians interpret diagnostics. Handheld accessible portals will soon be able to apply the power of a cloud-based IBM Watson to health and medicine, enabling the clinician to: enhance the speed, accuracy, and cost-efficiency of diagnostics; obtain decision support for applying evidence-based data sets; and choose the most appropriate therapy for an individual patient (drug, device, or surgical intervention).[51]

Advanced analytics and genomics driving innovation

Advancing data exchange using cloud technology to improve productivity of clinicians

In October 2017, GE Healthcare received Carequality certification to enable seamless data sharing by its ambulatory EHR customers with thousands of hospitals, physician practices, payer networks, vendors and consumer services nationally. Beyond meeting the criteria to participate in the Carequality Interoperability Framework, which includes legal, policy and technical qualifications for interoperability, the company has achieved effective integration of connected data and data exchange processes into clinician workflows. It has done so by introducing Centricity Healthcare Connections Hospital Connect for Centricity Practice Solution and Centricity EMR customers. This workflow-focused information exchange solution in the cloud has a strong emphasis on usability, saving individual clinicians at least one hour per day on chart reviews and information searches, reducing the number of duplicative tests and unnecessary services, and delivering higher quality, more personalised care to patients. As of August 2017, more than 260,000 physicians across approximately 23,000 clinics and 850 hospitals can share health data through Carequality.[52]

The centralisation of data in 2017 from numerous sources around the patient

Tech company data

CRO data

Insurers data

Genomics data

Social care data

Wearable and smart home device data

Mobile device data

Hospital data

Physician data

Individuals and patients

Pharmacy data

Other care provider data

Government data

Consumer data

Pharma

Industry regulator data

R&D data

Source: Deloitte research, 2017

2022

The future of medicine is here and now

Exponential advances in life-extending and precision therapies are improving outcomes

Prediction By 2022, medicine is fully Predictive, Preventative (based on predictive risk), Personalised and Participatory (P4 Medicine). Insights from human genetics, precision and personalised medicine has transformed health care, bringing value through innovative biotechnology and requiring the health system to move away from looking at the average patient to looking at the individual patient. AI has revolutionised health care through mining medical records, designing treatment plans, speeding up medical imaging and drug creation. Various precision medicine initiatives are underway for specific groups (such as the 'Million Veterans' initiative for military veterans), for diseases (such as the Oncology Precision Network for cancer) and the UK's '100,000 Genomes Project'. Genomic driven medicine has already had some initial success improving our understanding of treatment options. For example, therapies in immuno-oncology are raising the prospect of personalised vaccines to cure cancers. Outcome-based payment strategies are common for treatments where patient populations and end points are well-defined.

The world in 2022

- Computational biologists, in 'hoodies and jeans', are responsible for most drug discovery, mapping genomic pathways and finding gene expressions.
- The impact of AI allows data scientists and bio-scientists to work differently and collaboratively.
- Diagnostic biomarkers are used in real-time monitoring, R&D and treatment.
- Genome editing technologies such as CRISPR enable scientists to alter genomes, engineer and boost immune cells, and target proteins that are the underlying cause of diseases that were previously considered untreatable.
- Adaptive proteins that are the underlying cause of diseases and models for real-time trials are well-established and commonly used, bringing treatments to market proteins that are the underlying cause of diseases years earlier.
- Cancer is becoming a chronic disease as liquid biopsies uncover signs of DNA shed from a tumour into the bloodstream, gene editing technologies and cell therapies such as CAR-Ts (chimeric antigen receptor T cells) and other types of regenerative medicines, become the standard of care.
- A new generation of biologics using recombinant DNA technology has been developed on the back of years of research.
- Improved understanding of the microbiome has helped researchers recognise the diversity and functionality of the gut microbiome and its correlation to many diseases. This has given rise to new diagnostic, nutritional and medical therapies.
- Cell and gene therapies leading to curative treatments have led to payers introducing new approaches to value assessment, payment and financing.

Conquered constraints

- A new social contract, which optimises scientific discovery and patient autonomy, has led to more engaged participants and a more rigorous approach to regulation and patient safety.
- Drugs, devices and diagnostics have combined into health care solutions for a particular disease area, made possible by new forms of regulation.
- Both payers and pharma have developed their capabilities for managing risk and value-based contracts.
- Outcome-based evaluations are the agreed performance metrics between companies and insurers.
- Innovative contract arrangements have become increasingly common, based on risk and value sharing.
- The rise of the quantified-self, genomics, social media, and the exponential growth of online patient communities have shifted the attention of regulators to monitoring performance in the real-world.
- Governments have become more directive in the research they fund and the medicines they expect industry to develop (for example anti-infectives).
- A computational biologist is a new academic qualification – combining engineering, software/analytics with biology training.
- In 2019, the EMA's big data 'roadmap' and recommendations on changes to legislation, regulatory guidelines and data security provision was agreed by member countries, clarifying how drug regulators use data to support research, innovation and robust medicines development.

Note: All elements on this page are Deloitte's view of the world in 2022

Imagining the world in 2022

What if regulators harnessed the 'cloud'?

The increasingly complex regulatory environment, together with global alignment between regulators, has driven the development of a cloud-based infrastructure that is shared between industry and regulatory agencies, enabling real-time regulatory compliance and monitoring.. Access to this infrastructure has allowed biotechnology companies to maintain their advantage of nimbleness against 'big pharma', while simultaneously achieving enhanced regulatory outcomes. Adaptive licensing and real-time trials are also supported effectively for the first time, shortening development cycles. Adept stewardship of regulatory compliance activity by small, medium and large organisations is now a distinctive competitive advantage.

A patient portrait in 2022

Harriet has suffered from rheumatoid arthritis for fifteen years. Until recently the only treatment option open to her were drugs used to block TNF (tumour necrosis factor) – the substance involved in inflammation. Suffering from side effects and worried about the increased risk of cancer due to the drugs, Harriet was excited to be enrolled in a clinical trial last year. A pacemaker-like device was implanted below her left collarbone, with wires running to the vagus nerve in her neck, stimulating the nerve and reducing levels of molecules in the spleen linked to inflammation. The technology uses a programmable jelly bean-sized device that sits on the vagus nerve and can be charged using a collar and controlled by a tablet computer. The research seeks to confirm that the device, which had been used to tackle treatment-resistant epilepsy and depression, could be extended to rheumatoid arthritis by blocking the release of TNF. Harriet experienced a significant improvement in her disease. "Within six weeks I felt no pain. The swelling has gone. I go biking, walk the dog and drive my car. It is like magic."
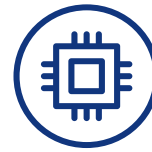
Using technology to improve the cost-effectiveness of R&D

In May 2022, the FDA approved a new gene therapy oncology drug. While gene therapy drugs have been available for the past five years, this latest drug was developed using a number of new technologies and strategies that show that innovations in drug development and approval are bearing fruit. Most pre-clinical testing was performed using an organ-on-a-chip model that was significantly faster and less expensive than the animal testing that had previously been required. This technology also shortened clinical testing for safety and efficacy, and performing parallel in silico clinical trials – computational modelling of trials using a virtual population – also decreased costs and development time. In addition, the use of RWE throughout development gave specific insight into how well the drug worked and how patients responded. Overall, the pharma company was able to reduce development time of the drug, which allowed it to get to market faster. Research and development costs were only $500 million, about a third of the average cost across the industry five years previously.[53]

Evidence in (**2017**)

A tsunami of science and new medicine

CAR-T cell therapy marks a fundamental shift in cancer treatment

Adoptive T-cell therapies involve removing the patient's T-cells, changing them to better attack cancer cells, and reinjecting them into the patient. For example, chimeric antigen receptors (or CAR) are added to T-cells (CAR-T) and injected into the patient, where they replicate and attack specific cancer cells by targeting tumour antigens on the cell membrane. Using CAR-T therapies to treat blood malignancies has shown response rates as high as 70-90 percent, but further research is required to see if the technology will have similar success in treating solid tumours. Although the narrow clinical indication of each CAR-T therapy makes the therapy possible only for patients at a certain age, with certain cancer types and at a certain stage, it may well propel the industry of cell immunotherapy into a new era. Market forecasts estimate that the global CAR-T market will reach $10 billion within 10-15 years, with a further future market potential of $35-100 billion.[54]

Precision medicine and other insights are driving innovation in oncology treatments

Over the past few years, there have been major advancements in oncology, boosted by increasing molecular and cellular mechanistic insights and applications of precision medicine. Tailored treatment for BRCA-positive mutation carriers and breast cancer patients is now widely available. Patient stratification is being driven by molecular markers and gene signatures. Immunotherapy has opened up avenues to use the immune system to combat cancer, which in some indications is already becoming the new standard of care. Along with these developments, clinical trial design is continually evolving, focussing on tumour heterogeneity among different patient populations. Furthermore, new technologies such CRISPR gene editing and 3D bio-printing are expected to broaden and sharpen our ability to identify novel therapeutic targets. However, there is also a need to focus on continuous improvement cycles.[56]

The 21st Century Cures Act is advancing biomedical innovation

The 21st Century Cures Act allocated a total of $6.3 billion to be spent in the US over the next ten years, commencing in 2017 and aimed at advancing biomedical innovation. Some £4.8 billion was allocated to the National Institutes of Health (NIH) and the remainder to the FDA. The Act established the FDA Innovation Account, providing the FDA with $500 million to implement initiatives for faster drug approvals and develop updated guidance. The Act also created the NIH Innovation Account, with $4.8 billion allocated as follows: cancer research ($1.8 billion); brain research ($1.5 billion); precision medicine ($1.4 billion); and regenerative medicine ($30 million). Other provisions target Health Information Technology and public health priorities.[55]

Improving the impact of our understanding of the microbiome

The largest study of the human microbiome began in August 2017. The Microbiome Immunity Project is run by IBM in partnership with the Broad Institute of MIT and Harvard, Massachusetts General Hospital, University of California, San Diego and the Flatiron Institute. It aims to understand how trillions of bacteria in and on our bodies impact diseases like Type 1 Diabetes, Crohn's disease and ulcerative colitis – illnesses diagnosed with increasing frequency.[57]
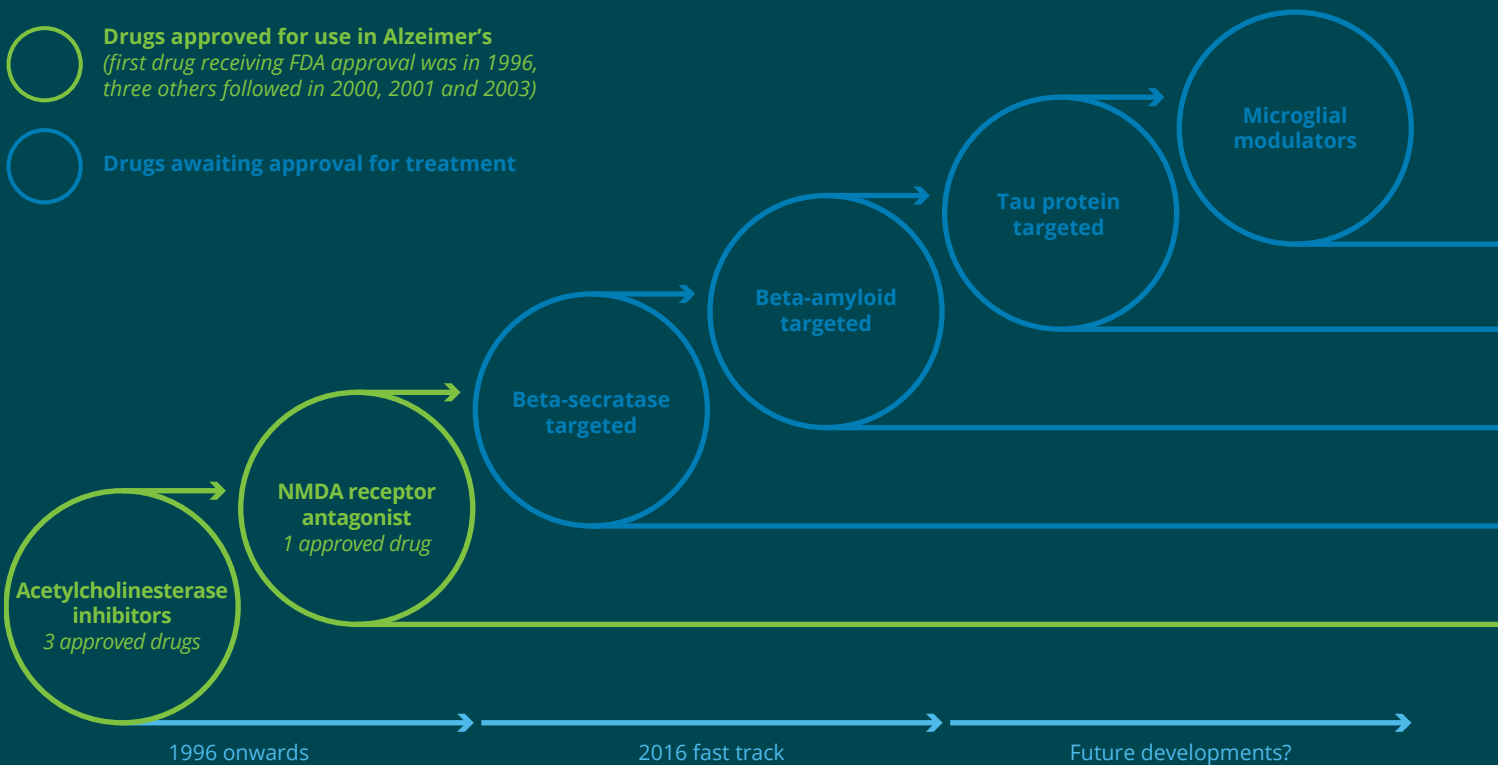
Real-world evidence

Deloitte's 2017 benchmarking study, *Getting real with real-world evidence (RWE)*, found that many biopharma companies are starting to invest in RWE capabilities and are exploring a number of use cases. In 54 per cent of respondents, a project is underway to develop and/ or significantly improve this capability, while 33 per cent said an RWE capability currently exists, and only relatively minor updates/ improvements are needed.

Innovative approaches to new treatments

The scale and impact of dementia

Dementia affects 50 million people worldwide – a number that is growing by 10 million every year (or a new case every three seconds). It is the leading cause of disability and dependency among the elderly. More than half of all people with dementia live in low- and middle-income countries, where as few as 10 per cent of individuals receive a diagnosis. There are over 100 forms of dementia, and in 2018 dementia will become a trillion-dollar disease. The most well-known form of dementia is Alzheimer's disease, which accounts for 50-60 per cent of all cases. Currently more than five million Americans are living with Alzheimer's. By 2050, unless prevention improves or there is a treatment breakthrough, the numbers could be as high as 16 million. In 2017, Alzheimer's and other dementias were estimated to cost the US health care system more than $259 billion, potentially increasing to $1.1 trillion by 2050. Treatments that could delay the onset by five years could save roughly $367 billion annually in long-term care and other health care costs.[58]

In dementia, more specifically in Alzheimer's disease, progress developing new treatments has been very limited, demonstrating the scientific risks facing the industry

Drugs approved for use in Alzeimer's
(first drug receiving FDA approval was in 1996, three others followed in 2000, 2001 and 2003)

Drugs awaiting approval for treatment

Microglial modulators

Tau protein targeted

Beta-amyloid targeted

Beta-secratase targeted

NMDA receptor antagonist
1 approved drug

Acetylcholinesterase inhibitors
3 approved drugs

1996 onwards   2016 fast track   Future developments?

Source: Deloitte research, 2017

The search for a treatment for Alzheimer's disease

Alzheimer's disease remains one of the most complex diseases researchers have ever studied. Between 1998 and 2014, 123 potential medicines for Alzheimer's were halted in clinical trials, and just four medicines were approved. In 2017, biopharmaceutical research companies in the US are investing in or developing 87 potential treatments (16 are in phase III and another eight are in phase II/III or have completed Phase II). These comprise disease-modifying treatments that may stop or slow down disease progression, including targeting beta-amyloid plaques that appear between nerve cells, tau protein tangles that damage and kill brain cells and a receptor that decreases a neurotransmitter necessary for the brain to think and function normally. Other potential medicines are aimed at decreasing inflammation in the brain associated with Alzheimer's and targeting the immune system to fight the disease. Researchers are also investigating prevention in patients with gene mutations associated with Alzheimer's.[59]

2022

New entrants are disrupting health care

The boundaries between stakeholders have become increasingly blurred

Prediction In 2022, the health care landscape has changed significantly, with non-traditional health care players using their brand, engineering expertise and knowledge of customers to disrupt the health care landscape. These new entrants have partnered with traditional providers to deliver a more customer-focussed experience of health care. New partnerships and collaborations at both global and local level have blurred the boundaries between providers. New entrants, including supermarket chains, technology giants and life sciences companies, have optimised their understanding of different consumer groups. For example, pharma companies have adopted an enhanced role in health care, using their customer relationships (rather than medicines) as their strongest asset, and insurance companies have partnered with pharmacies to run lifestyle wellness clinics. Telehealth companies are bringing health care to people's doorsteps or workplace, as new entrants partner with or supplant incumbents to pioneer pathways into virtual health care. Many companies have realised that only by working together can they succeed, requiring new skills, behaviours and standards to be adopted in each organisation, with more porous boundaries between organisations. Initiatives have helped deliver more affordable and convenient treatment options and influenced the growth of preventative medicine.

The world in 2022

- Following years of mergers and acquisitions, collaborations between health care providers and digital technology companies have created more agile, customer-focussed organisations.

- Businesses and governments have implemented population health management models and work with communities of patients, providers, payers and partners to identify best practice and cost-effective treatments.

- Pharma companies have adopted an amended and enhanced role in health care. Their detailed knowledge of patients and clinicians is a key asset in developing new, customised treatments.

- Logistics businesses have entered the home delivery and home-care support markets.

- Companies manufacturing robots and home appliances have worked with providers to develop new home help(ers) for managing care.

- All stakeholders in the health ecosystem have developed products and services that mirror the way we bank, book plane tickets and watch movies, emphasising convenience, mobility, connectivity, price transparency and an 'anywhere, anytime' ethos.

- Consumers are happy to use mobile and video consultations and alternative care venues like supermarkets and kiosks to obtain an initial diagnosis and on-going care from more affordable, convenient providers.

- Payers have invested in extending providers to include community resources, patient navigators and local non-profits.

- Payers now cover, as a matter of routine, the prescribing of nutritional supplements, gym memberships, health apps and smart pills.

Conquered constraints

- While privacy and security of data remain a concern, patients are more confident sharing their health data with trusted providers, with the knowledge that they are compliant with regulatory standards.

- Insurance companies and providers embrace complex patients, having invested in analytics and population health management programmes to deliver new care pathways.

- Clinicians now actively engage in endorsing use of technology-enabled care (TEC) and prescribing of non-drug therapies.

- New providers and industry models, including mutuals and other forms of co-operation, have helped to decrease costs and improve care.

- New models of staff deployment, skills and talent development have helped to bridge the skills gap.

- Many new entrants into the payer and provider markets who initially found that the high level of regulation made disrupting health care harder than it looked have partnered with traditional players to achieve mutually beneficial outcomes.

- Partnerships between health care providers and pharmacy distributors have improved the productivity of the health care supply chain.

Note: All elements on this page are Deloitte's view of the world in 2022

Imagining the world in 2022

What if a tech giant established a virtual health care organisation?

Health care in your pocket enabled by smartphones has become ubiquitous – a 'one stop shop' for health information. Cameras and sensors located in smartphones are used to measure and monitor blood pressure, pulse rate and oxygen saturation and compute an electrocardiogram or galvanic skin response that may be indicative of emotional state and/or other physiological conditions. This then links to its electronic digital platform that allows users to create, read and share their personal health records, providing a universal patient health record that can be shared with multiple health care professionals. In addition, the platform integrates lab results, prescription information, allergy reports and visits to the doctor – all data available for viewing any time and shared with doctors and third parties with a single tap. Personalised alerts, linked to intelligence gathered via smart pill boxes and other innovations, are sent to patients, along with health information on why adherence is important. Initial barriers due to confidentiality, security and interoperability between software systems have been overcome, speeding up and dramatically improving the effectiveness and lowering the costs of health care processes for millions of people.

A patient portrait in 2022

Having lived all her life in a small English village, Patricia was diagnosed with advanced dementia in 2018. Her dearest wish was to remain safely in her own home, despite her cognitive limitations. She was assigned a team of community nurses who have adopted the Dutch Buurtzorg nursing model. The care team have developed a care plan to ensure she takes her medications appropriately. Each morning, a nurse from the team visits Patricia and helps her with her medications and identifies any other health care needs. The nurse brings any concerns to the attention of Patricia's primary care provider. In between visits, Patricia is monitored remotely via the telehealth hub that works in partnership with her primary care provider to continuously and unobtrusively track, her vital signs and physical movements. The telehealth provider has installed sensors and alarms throughout Patricia's customised bungalow and provides online access to Patricia's family, who live some distance away, so they can also keep an eye on their mother from their own home. The local pharmacy delivers medications directly to Patricia's home under an agreement with the telehealth provider. Patricia enjoys using her customised smart tablet, which she sees as a life-line to friends and family and stops her from feeling lonely or isolated and, indeed, helps to calm her when she is feeling agitated.
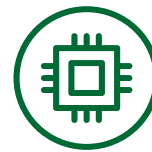
A day in the life of a pharma company's social media department

A pharma company's social media department has been operating for three years and has enjoyed a number of notable achievements in supporting key brand launches and winning several new media awards, transforming their relationship with consumers. The department was singularly responsible for helping both patients and payers understand that, not only was the efficacy of the drug and service package superior to the previous care packages, it also encouraged the right behaviour change in patients, creating long-lasting health and cost benefits. It was also responsible for building a new form of trust amongst patients, doctors and the pharma company. Regular consumer surveys made it clear that they expect a health care experience that mirrors the convenience and transparency of their banking, retail, transportation and other purchasing experiences. This required new business models that depend on collaboration. Therefore, the company partnered with a global tech company to provide automated patient guidance and engagement solutions, such as AI-enabled medication adherence, to observe patients using advanced facial recognition and motion-sensing software to automate directly observed therapy.

Evidence in 2017

Partnerships and collaborations are transforming health care delivery models

Smartphone use as a medical device

During 2016, the FDA cleared 36 smart devices, with connected blood glucose monitors and devices incorporating heart rate sensors dominating the list. Other examples include: a Kinect-based physical therapy system which physiotherapists can use to create personalised gamified routines for patients; a connected contact lens that helps physicians track the progression of glaucoma in patients; a remote patient monitoring system that helps detect cardiac arrhythmias in patients; a smartphone-controlled device that uses nerve stimulation to treat chronic pain; and a pocket-size sensor and corresponding app to track lung function to help people manage asthma and other respiratory conditions. There is a smartphone-connected breast pump that allows users to track pumping sessions, record their child's feedings, and manage breastmilk inventory, a digital stethoscope and a small portable ultrasound that can connect to mobile devices. The increase in clearance of mobile and wearable devices continued during 2017, of particular note was the FDA clearing 23andMe to sell its direct-to-consumer genetic test kits, three years after telling the company to stop selling its kits.[61]

Philips provision of point-of-care technology-enabled health care services

Philips provides population health management and hospital-to-home enterprise-wide telehealth services, comprising advanced digital platforms that help care providers understand their populations, navigate care and activate patients. Next to this the company offers home monitoring, medication management, personal emergency response systems, and personal health services. These services provide support to multiple population groups - from intensive ambulatory care for high-risk patients to prevention. Philips is also helping hospitals and home service providers deliver coordinated care support. Philips' 'sweet spot' is at the point-of-care, enabling consumers, patients, care teams and clinicians to optimise care and achieve goals. Its eICU patient monitoring solution is enabling a 26 per cent reduction in ICU mortality. Its ambulatory care programs show a 49.5 per cent reduction in hospital admissions and a reduced overall costs of care by 34.5 per cent. One study on its medication management system in the Netherlands found a medication adherence rate of around 94 per cent, with medication adherence remaining consistent over time and potential costs saving of up to 40 per cent per patient when connected dispensing solutions are part of the patient's regime.[60]

Examples of tech giants moving into health care:

- Amazon is already leading in the cloud data storage arena and is said to be launching a new health care lab called 1492, focusing on improving interoperability and building out its Alexa voice assistant product suite to address health-related use cases.
- The Apple Watch®, CareKit®, and ResearchKit® initiatives, which collect personal health data, are already being used for research into chronic diseases and population health. The company is also exploring the development of an iPhone®-based EHR, which would boost its ability to combine patient-generated health data with more detailed clinical data to offer sophisticated population health and personalised care analytics.
- Home genetic testing company 23andMe and Google X research labs' machine learning subsidiary DeepMind are expanding into R&D in an effort to establish themselves in leadership roles in the melting pot of clinical analytics and life sciences, with aspirations to produce a new generation of clinical decision-support tools to augment the skills of highly-trained clinicians.[62]

The use of precision medicine to improve cancer diagnosis and treatment in China

The Chinese government is investing heavily in genomic technology and, in 2016, launched a $9.2 billion precision medicine initiative to promote a genomics infrastructure nationwide. Meanwhile, IBM Watson struck a deal with Hangzhou Cognitive Care in 2016 to deploy IBM's Watson for Oncology platform across 21 Chinese hospitals, providing customised cancer treatment solutions. In 2017, IBM signed a strategic partnership agreement with Baheal Pharma (Bai Yang Medicine Group) in Beijing, introducing Watson Health across the Chinese health sector and available to clinicians and researchers across the country. Watson for Oncology will help improve cancer care decisions by scoring and ranking medical literature, rapidly summarising patient records and deploying oncology expertise. The intention to reach every oncologist in China comes at a time when Chinese cancer diagnoses are steadily increasing, with an estimated 4.3 million new cases (25 per cent of the world's cases) and 2.8 million deaths in 2015 alone.[63]

Non-traditional health care providers are driving a more patient-centric experience
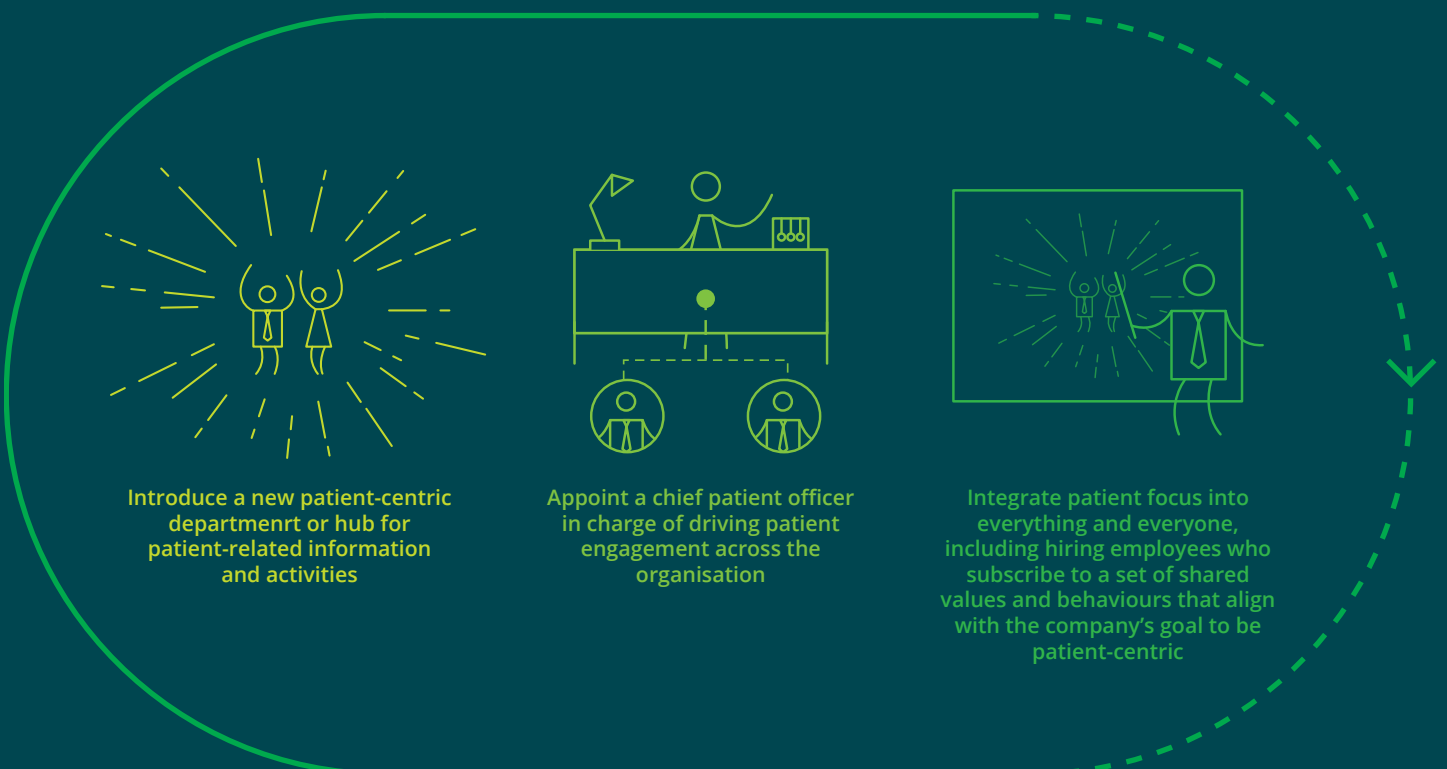
Non-traditional health care companies are competing with traditional providers on the basis of convenience and consumer engagement

The future experience of health care requires an ecosystem of entities that align their business models with consumer goals through a shared commitment to collaboration, interoperability and consumer empowerment. Traditional and non-traditional health care companies increasingly compete on the basis of consumer engagement. In the US, brick-and-mortar retailers (such as Walgreens, CVS Health and Walmart) and telemedicine outlets (like Teladoc, American Well and Doctor on Demand) now compete with conventional health care delivery organisations on convenience. Vertically-integrated payers and providers are leveraging their aligned interests to shift to population health business models, improve consumer engagement, and empower consumers to change behaviour and drive down costs. Payers, providers and life science companies are all investing in direct-to-consumer engagement strategies, acknowledging that engaged consumers achieve better health outcomes.[64]

Pharma and the connected patient

There is a growing realisation within the pharmaceutical industry that a new business model is needed if the industry is to thrive. With the best health outcomes dependent on patient activation and engagement, pharma companies have recognised that by engaging and partnering with patients across the entire pharma value chain, they can re-invent their business and operating models. A key enabler of the transformation towards a patient-centric model is advanced digital health technology and analytics. While pharma has been slower than many other industries in responding to the digital technology revolution of the 21st century, this is changing. Pharma is embracing digital technology's potential for creating a new patient-centric business model, based around developing new, more personalised drugs for smaller groups of patients, and monitoring and managing patient adherence and health outcomes.

Pharma companies are using a number of key strategies to achieve their ambition of becoming more digitally-enabled and patient-centric

Introduce a new patient-centric departmenrt or hub for patient-related information and activities

Appoint a chief patient officer in charge of driving patient engagement across the organisation

Integrate patient focus into everything and everyone, including hiring employees who subscribe to a set of shared values and behaviours that align with the company's goal to be patient-centric

Source: Deloitte research, 2017[65]

Conclusion

The methodology for this research included discussion and debate across our life sciences and health care teams and drew on our combined experience of working across the industry. Our research was undertaken against a backdrop of increasing challenges faced by health care systems across the world – from unrelenting demand pressures, growing public expectations, and an increasingly constrained and beleaguered clinical workforce. While all countries aspire to the quadruple aim of health care – improved patient experience, better population health outcomes, staff and carer wellbeing, and affordable costs – they differ in how much they are prepared, or able, to spend and what services they decide to prioritise. Our predictions therefore look to a world in five years' time where countries are benefitting from new information, data and insights about health care, what works and what doesn't and how new innovation, collaboration and automation can improve the efficiency, effectiveness and affordability of service delivery.

Each of our six predictions shares three key enablers that are critical to the realisation of the prediction and will impact the pace of change:

- wide-scale adoption of new digital and cognitive health technologies
- recruitment and retention of new skills and talent
- a new approach to regulation.

Adoption of new technology
All technology evolves before it becomes mainstream or fails to be adopted at scale. Our six predictions highlight the important role and likely revolutionary adoption of advanced digital and cognitive technologies. The life sciences and health care industries have traditionally been risk-averse in adopting innovation and slow to derive insights from data and analytics due to a multiple disconnected systems, poor data quality, and difficult-to-change patient and provider behaviours. Today we are at a tipping point in advanced technology adoption. Personalisation, coupled with an explosion of electronic health information, are driving trends in value-based care and precision medicine. Indeed, pharmaceutical, medical device, and biotechnology innovators are harnessing digital technology and the power of big data and analytics to deliver a more cost-effective approach to health care.

Acquisition of appropriate skills and talent
Across all six predictions, the delivery of efficient and effective services requires organisations to have access to appropriate specialist and generalist skills and talent, including digital and analytical skills. Deloitte's 2017 report, Global Human Capital Trends, has identified paradigm-shifting forces such as cognitive technologies and the open talent economy that will reshape the future workforce. These forces are driving many organisations to reconsider how they design jobs, organise work, and plan for future growth. How the health care industry responds in relation to recruitment and retention of the right talent and skills will determine how well the predictions are realised. While many tasks are being automated, the 'essentially human' parts of work are becoming more important; skills such as empathy, communication, persuasion, personal service, problem solving, judgement and strategic decision making are more valuable than ever. These skills have always been and will continue to be important in health care.[66]

A new approach to regulation
For the past decade, most life sciences and health care companies have highlighted that a risk-averse approach to regulation has impeded adoption of innovation. The evidence today and predictions for tomorrow illustrate that this is changing.

For example, the FDA's new early approval process for CAR-T cancer treatments reflects efforts by the new Oncology Center for Excellence to implement a more collaborative review model for innovative medicines. The FDA also launched a Digital Health Innovation Plan aimed at fostering medical technology innovation while streamlining routes to market. A major part of the plan is to clarify regulations around mobile health apps. The agency hopes the initiative will help cut down on the time and money needed to enter the digital health market. Meanwhile, the EMA, along with the heads of national competent authorities in the EU, have formed a new taskforce to establish a roadmap and recommendations on how drug regulators can use data to support research, innovation and robust medicines development.

Adopting these enablers should see the life sciences and health care industries survive and thrive.

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