Pushing the frontiers of what's possible

The top 10 global healthcare innovations

What innovations are most likely to help stakeholders achieve improved care, improved health, reduced spending, and healthcare transformation over the next 10 years?

Healthcare is an industry in need of innovation. Health plans, providers, life sciences companies, and the government are facing rising costs and inconsistent outcomes. They are working to achieve the triple aim — improving care, improving health, and reducing spending. Our current healthcare system's performance can be defined by its rules, policies, regulations, enabling technologies, operating models, customs, and patient and provider preferences; together, these elements comprise the frontier of what is possible. They also serve as the constraints to what can be achieved. For far too long the healthcare industry's performance, despite attempts to spur progress, has remained at the edge of this frontier. The industry needs to break current constraints and expand the frontier to achieve true breakthrough performance.

Whilst the constraints are many, the traditional, dominant, fee-for-service (FFS) payment model, in particular, does not align provider incentives with the goal of achieving more for less.

The 10 innovations we describe in this report have the potential to break the constraints of the FFS-based healthcare system and expand the frontier through new business models that can deliver care in ways previously not thought possible. Early adopters of these innovations are likely to be those already experimenting with business model changes as a result of recent, transformational market shifts: value-based care (VBC), consumerism, and the proliferation of new data sources.

Stakeholders should also consider building pilots before investing in scale.

Incentives for providers

VBC creates incentives for providers to experiment with care management and patient engagement approaches that could improve health outcomes and reduce spending. Some stakeholders are recognising the importance of activating patients in their own care and are investing in capabilities to encourage this. Meanwhile, new data sources and tools are informing clinical trial design, treatment decisions, and ongoing patient care.

Incorporating these top 10 innovations into business models will require changing how healthcare organisations currently prevent, diagnose, monitor, and treat disease. Leaders should determine which innovations break performance trade-offs, or create "more for less," in a way that impacts their core business.

Healthcare leaders should consider building ecosystems that embrace non-traditional players and sources of knowledge outside their own four walls. Stakeholders should also consider building pilots before investing in scale, learn to embrace change, and evaluate new revenue sources. And organisations should strive to be agile in anticipating and adjusting their strategies as innovations continue to evolve. Advances in genetic sequencing could lead to the development of diagnostic tests that may

identify at-risk populations where early interventions could save downstream healthcare costs.

Next-generation sequencing (NGS)

Diagnostic tests also may help clinicians target specific medicines to patients who are likely to respond well to them, reducing or eliminating the use of ineffective treatments. Rapid progress in genetic testing is expected to help accelerate scientists' and clinicians' understanding of genetic indicators for susceptibility to various diseases, and patients' likely response to treatment.

Researchers working on the Human Genome Project completed sequencing the first human genome in 2001, and it took 15 years and cost US$3b. Since then, advances in sequencing techniques have led to exponential increases in the data output for each sequencing run, from 84 kilobases of data to 1.8 terabases of data. Meanwhile, genome sequencing costs have dropped substantially; current NGS techniques can sequence 45 human genomes in a day for US$1,000.

Genetic testing can have broad applications in population health screening and identification of at-risk populations where early intervention would be beneficial. Identifying sub-populations that might be more responsive to treatment could help get the right drug to the right patient at the right time. This, in turn, could reduce inefficiencies and generate more consistent responses for patients receiving treatment.

3D-printed devices

Examples of 3D-printed medical technologies include 3D-printed prosthetics, skin for burn victims, organs, implants (dental and orthopedic), and casts. In some applications, 3D printing offers solutions where none existed; for example, airway splints for babies with tracheobronchomalacia (a rare condition where the tracheal or windpipe cartilage is soft). Other applications, such as 3D-printed prosthetics, offer more customised and lower-cost alternatives than the current standard of care. 3D printing also aids physicians with surgical planning — they can study exact replicas of patients' organs before going into surgery. Additive manufacturing (AM) techniques are enabling 3D-printed medical devices to enter the market at a reasonable price point. AM technology provides the ability for mass customisation and reduces waste.

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For example, the airway splints for babies with tracheobronchomalacia can be made in a matter of hours and cost about US$10 per unit. 15 AM works by adding materials layer by layer, rather than producing something and cutting away the excess. This approach could potentially disrupt traditional supply chains in two ways. First, AM requires less capital to achieve scale economies, reducing the minimum efficient scale — the point at which the average cost of each unit of production is minimised. Second, AM decreases the amount of capital needed to achieve scope economies, as its flexibility allows for the same equipment, materials, and processes to be used to produce multiple different products

Immunotherapy

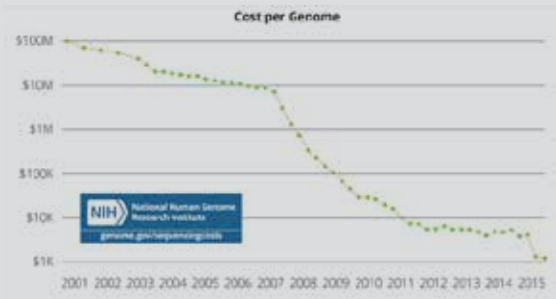
Immunotherapy refers to classes of drugs that strengthen the body's ability to generate an immune response. Immunotherapy could be useful in the treatment of cancer, allergies, inflammatory conditions, infectious diseases, and neurodegenerative diseases. Successful applications have been seen in oncology, where therapies can counteract how tumors suppress the immune system and instead help the immune system to effectively attack tumor cells. Researchers are particularly interested in two classes of therapies: checkpoint inhibitors including PD-1 and PDL-1 inhibitors, and adoptive t-cell therapy, including CAR-T.

Checkpoint inhibitors: Checkpoints are molecules that help the immune system distinguish normal cells from foreign cells. Cancer cells may express some of these checkpoint molecules to prevent from being recognised and attacked. Checkpoint inhibitors target these checkpoint molecules and essentially turn them off, making the tumor cells more visible to the immune system. The FDA has approved three of these drugs.

Adoptive T-cell therapies: Adoptive T-cell therapies involve removing the patient's T-cells, changing them to better attack cancer cells, and re-injecting them into the patient. Chimeric antigen receptors (or CAR) are added to the T-cells (CAR-T) and injected into the patient, where they replicate and attack the cancer cells. Immunotherapies have already shown early signs of success. Checkpoint inhibitors are increasing progression-free survival. Using CAR-T to treat blood malignancies has shown response rates as high as 70-90%. Further research is required to see if the technology will have similar success in treating solid tumors.

Further progress for immunotherapy may depend on innovators' ability to invest in additional research to understand what biologic molecules are responsible for triggering tumor susceptibility. Low participation in clinical trials and the need to study individualised responses make further research challenging; develop a scalable manufacturing process. The use of CAR-T is limited to specialised labs where clinicians are trained to handle risks and potentially life-threatening adverse reactions, and; demonstrate evidence of significant improvement over the standard of care, and long-term efficacy to gain reimbursement. Some immunotherapies

Decreasing genome sequencing costs



Source: National Human Genome Research Institute, "The cost of sequencing a human genome."

have shown efficacy in combination with other therapies, with high treatment costs reaching above $250,000.

Artificial intelligence (AI)

Within healthcare, AI includes clinical tasks such as diagnosing patients and spotting disease outbreaks earlier, accelerating the development of new drugs and devices, and streamlining administrative duties such as approving claims and rooting out fraud. Frost and Sullivan projects that 90% of US hospitals and insurance companies will implement AI systems by 2025. AI has the potential to improve the accuracy, precision, and timeliness of patient diagnoses, which could increase therapeutic success rates and decrease unnecessary medical interventions. Population health would improve with better understanding of behavior patterns that impact chronic disease outcomes.

Streamlining administrative duties may improve operational efficiencies. Increased adoption of AI will likely depend on: innovators' ability to decrease cost and improve accuracy of technologies such as natural language processing, big data, and cognitive technologies, and; Healthcare professionals' and patients' acceptance and trust of AI tools.

Point-of-care (POC) diagnostics

Patients can use POC diagnostics in the physician office, ambulance, home, or hospital. Current widely available home POC tests include blood glucose, pregnancy, and HIV. Some medical device and diagnostic companies are developing POC tests for cancer, tuberculosis, and stroke markers, amongst others. POC diagnostics could aid in prevention, early diagnosis, and management of chronic conditions. Providing test results when patients are receiving care speeds diagnoses, increases care efficiencies and, potentially, decreases costs associated with delayed treatment.

Analysts expect the market for POC diagnostics will total nearly US$3b in 2021, up from US$2.13b in 2015. Further adoption of POC diagnostics will likely require: innovators to improve POC diagnostic technology, through lower cost, less invasive, easy to use, and more accurate tests, and; Healthcare providers to participate in the transition to VBC, which creates opportunities for clinicians to indirectly receive reimbursement for the time and costs of administering these tests.

Virtual reality (VR)

VR creates multisensory experiences using computer-generated images that appear on a headset. In healthcare, virtual reality has been used to support clinician training via surgery simulation. Research has shown positive impacts from VR in treating alcohol addiction and in changing behaviours to improve wellness, such as weight management and smoking cessation. VR may also aid patients with depression.

A 2015 proof-of-concept study on immersive VR demonstrated that it may help people be less critical and more compassionate towards themselves and, ultimately, may help reduce depression. Recent marketing of lower-cost VR systems for consumers (mainly for gaming) could mean increased access for patients in the near future. Currently, academic researchers are helping drive the use of VR in healthcare (with some private industry collaboration) in an attempt to demonstrate clinical effectiveness. VR-related research articles in the Pubmed database have increased over the last decade from 204 in 2004 to 720 in 2014.

In the future, VR could be integrated with technology advances such as AI, sophisticated biosensors, and increased computing power. For the innovation to reach its full potential, innovators should: consider VR as an extension of digital strategy, applying new technologies to transform customer engagement and employee empowerment; and demonstrate clinical efficacy for specific conditions to encourage clinician and health plan adoption.

Leveraging social media to improve patient experience

Just as retailers are using customer data to promote specific products, the healthcare industry is evolving its ability to apply data mining and predictive analytics to help improve population health and the patient experience. Social media can be a rich source of healthcare information that could be valuable to patients, researchers, policymakers, and hospital administrators. Social networks and online communities could play an important role in consumer health management, serving as hubs where patients and caregivers can meet to ask questions, share information, and compare experiences with treatments and medications.

The Deloitte Centre for Health Solutions 2015 Survey of US Healthcare Consumers found that 52% of consumers actively search online for health- or care-related information. Patient-generated content on these digital platforms illustrates the needs, wants, motivations, behaviours, and decision considerations of patients and caregivers.

This data can provide a valuable source of insights for providers and pharmaceutical companies seeking to understand how best to reach, engage, and support individuals across the patient journey. Social media also

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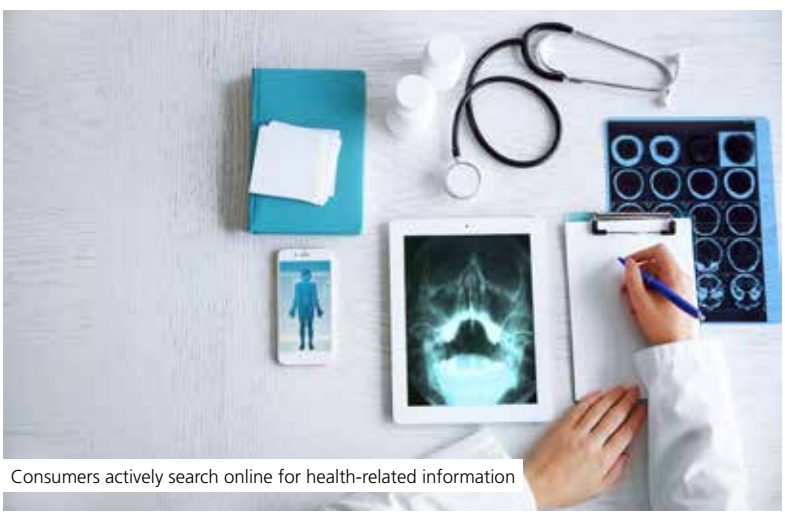
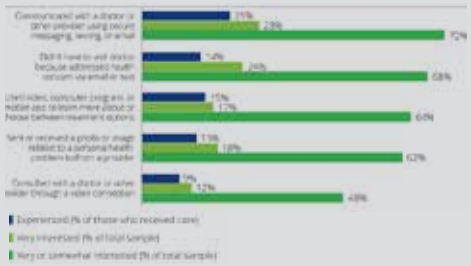


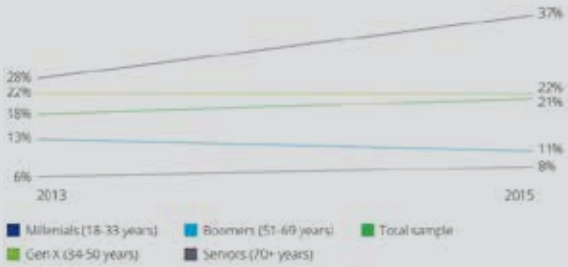
Consumers actively search online for health-related information

Consumer interest in communicating electronically with doctors is high



Source: Deloitte Center for Health Solutions 2015 Survey of US Health Care Consumers

Use of social media for health purposes by age cohort



Source: Deloitte 2015 Survey of US Health Care Consumers

can be used to track consumers' experiences with the healthcare system. Research has focussed on leveraging broad population data such as looking for certain terms on Twitter or other platforms, or using focussed disease communities to learn about patient preferences, symptoms, responses to treatment, and other quality-of-life measures. Several well-established surveys capture patient experience with the healthcare system, but it takes several months to publish results, and response rates are typically low.

Biosensors and trackers

Technology-enabled activity trackers, monitors, and sensors incorporated into clothing, accessories, and implantable medical devices are evolving to be able to monitor and sense an increasing number of health indicators. In addition to monitoring exercise, nutrition, and vital signs, these trackers and sensors could track changes inside a patient's body — medication levels, blood/hormone/protein levels, and device performance. Patients are more likely to accept these devices as they become smaller and less intrusive. Some envision that wearables will shrink to the point where they "disappear" from consumers' awareness. CCS Insights expects 411 million wearable devices ranging from eyewear to watches to jewelry to be sold in 2020.

Increased biosensing could improve patient engagement, medication adherence, disease monitoring, and ultimately, health outcomes. The collected data could be used by clinicians to intervene earlier and more often, and by researchers to better understand treatment effectiveness.

Convenient care: Retail clinics and urgent care

Retail clinics and urgent care centers are generally lower-cost sites of care that focus on a limited number of health issues. Pharmacies or health systems often own or partner to run a retail or urgent care clinic, and they are typically located within shopping centres or other public spaces. These alternative care sites offer extended hours, more locations, and shorter wait times.

The use of physician assistants, nurse practitioners, and pharmacists, under the supervision of physicians, lowers costs. As retail clinics expand their services to include areas such as chronic care management, educational and behavioural counseling, care coordination, and infusion centres, their impact may increase. According to the Deloitte Centre for Health Solutions 2015 Survey of US Healthcare Consumers, 77% of respondents choose retail clinics for their convenience, 72% for speed of securing an appointment, and 60% for after-hours care.

Greater utilisation of these lower-cost care centres would likely require: state regulators' expansion of the scope of services for non-physician providers, including pharmacists and nurse practitioners; health plan reimbursement for those services, either through traditional FFS or through VBC models in partnership with provider organisations; and retail clinic and urgent care center care coordination and demonstration of equivalent or superior care quality.

Telehealth

Telehealth is part of connected health (cHealth), technology-enabled integrated care delivery that allows for remote communication, diagnosis, treatment, and monitoring. Specifically, telehealth uses electronic information and telecommunications technologies to support long-distance clinical healthcare and patient and professional health-related education. Telehealth lets healthcare providers connect with patients and consulting practitioners across vast distances.

It offers the ability for patients to have more frequent, convenient, and low-cost touchpoints with their physicians. In addition, telehealth may enable closer monitoring, earlier diagnosis and intervention, and better adherence, ultimately resulting in lower cost of care. For healthcare organisations looking to implement or expand telehealth, it is important to note that simply giving consumers more access to care doesn't automatically translate to improved outcomes. But, organisations have shown that through a targetted approach, especially to certain high-risk populations who are covered under VBC models, telehealth programs can be cost-effective.

The US Department of Veterans Affairs (VA) has been using telehealth to enhance veterans' access to high-quality care for over a decade. VA has published some results of its home telehealth programmes for non-institutionalised care patients with chronic conditions, and the studies show that the programmes have resulted in sizable declines in several healthcare cost drivers (e.g., ER visits and admissions).

From Deloitte's "Top 10 healthcare innovations: Achieving more for less"

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