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**Top 10 health care innovations:**  
Achieving more for less

# Executive summary

Health care 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. What innovations are most likely to help stakeholders achieve these goals and transform health care over the next 10 years?

We surveyed leaders across the health care system to identify the innovations they think are most likely to transform health care. We then narrowed the list to the top 10 by applying the following definition:

**Innovation:** Any combination of activities or technologies that breaks existing performance tradeoffs in the attainment of an outcome, in a manner that expands the realm of the possible. Defined in health care as providing “more for less”—more value, better outcomes, greater convenience, access and simplicity; all for less cost, complexity, and time required by the patient and the provider, in a way that expands what is currently possible.

Our current health care 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 health care 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. While 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 top 10 list consists of innovations that will most likely achieve more for less in health care:

- **Next-generation sequencing (NGS):** Applications of genetic sequencing to identify at-risk populations or target therapies to patients who are likely to respond
- **3D-printed devices:** Lower-cost and highly customized medical technology products that can be tailored to suit the physiological needs of individual patients
- **Immunotherapy:** Treatments with the potential to significantly extend survival for cancer patients, without the negative side effects and related health care costs of traditional chemotherapy
- **Artificial intelligence (AI):** The ability of computers to think like and complete tasks currently performed by humans with greater speed, accuracy, and lower resource utilization
- **Point-of-care (POC) diagnostics:** Allow for convenient, timely testing at the point of care (e.g., physician office, ambulance, home, or hospital), resulting in faster, more cohesive patient care
- **Virtual reality (VR):** Simulated environments that could accelerate behavior change in patients in a way that is safer, more convenient, and more accessible

- **Leveraging social media to improve patient experience:** Tapping data from social media and online communities to give health care organizations the ability to track consumer experience and population health trends in real-time
- **Biosensors and trackers:** Technology-enabled activity trackers, monitors, and sensors incorporated into clothing, accessories, and devices that allow consumers and clinicians to easily monitor health
- **Convenient care:** Retail clinics and urgent care centers that provide more convenient and lower-cost care to patients for a number of health issues
- **Telehealth:** A more convenient way for consumers to access and increase self-care while potentially reducing office visits and travel time; may also prevent complications and emergency room (ER) visits

The 10 innovations we describe in this report have the potential to break the constraints of the FFS-based health care 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.

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 recognizing 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 health care organizations 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 nontraditional 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, organizations should strive to be agile in anticipating and adjusting their strategies as innovations continue to evolve.

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# Introduction

Public and private sector momentum towards achieving the triple aim is strengthening the business case for innovation in health care. (See sidebar: [Balancing innovation and regulation: The public sector's role.](#)) In this dynamic environment, what are the innovations most likely to transform health care over the next 10 years?

Deloitte conducted an external survey of innovation leaders across several segments of the health care system\* to gather their opinions about which innovations are most likely to transform health care over the next decade. Respondents suggested many ideas and we then applied our definition of innovation to narrow the list to the top 10.

While there are many ways to define innovation, we chose the definition used by Michael Raynor, author of *Innovation: A Chimera No More*:<sup>1</sup>

Any combination of activities or technologies that break existing performance tradeoffs in the attainment of an outcome, in a manner that expands the realm of the possible. More value, better outcomes, greater convenience, access and simplicity; all for less cost, complexity, and time required by the patient and the provider, in a way that expands what is currently possible.

In the context of the health care system, this requires breaking the constraints of FFS clinical models to provide better care, in the optimal setting, at the right time, with the right provider, to create better outcomes and access using enabling technologies that lower the overall cost of managing a population's acute and chronic care. It also means changing care delivery models to progress beyond the current limits of performance and cost of existing approaches and technologies.

The top 10 innovations include those with the potential to change how health care organizations prevent, diagnose, monitor, and treat disease. The potential impact of these innovations transcends traditional stakeholder segmentation (e.g., health plans, health care providers, and life sciences companies) and is anticipated to drive transformative change in business and operating models.

Some organizations are already experiencing business model transformation arising from payment model changes, new demands from consumers, and increased availability of data sources. The top 10 innovations are likely to accelerate transformation of the health care system across each of these three areas. Further, early adopters of the top innovations are likely to be organizations which are already embracing these market shifts:

**Aligning financial incentives:** The FFS payment model does not create financial incentives for providers to improve quality and does not typically reimburse for the use of nontraditional services. Rather, FFS could create incentives for physicians to provide more services, even if the incremental benefit may not be commensurate to the cost. The shift to VBC aims to change these incentives by tying payment to quality and total cost of care, rather than rewarding volume. Public and private payers have aggressive goals for the shift to VBC: The US Department of Health and Human Services (HHS) aims to link 50 percent of Medicare payments to quality or value through alternative payment models by 2018.<sup>2</sup> The Health Care Transformation Task Force, consisting of providers, health plans, and employers, has committed to shift 75 percent of its members' business into contracts with incentives for health outcomes, quality, and cost management by January 2020.<sup>3</sup> The Medicare Access and CHIP Reauthorization Act of 2015 (MACRA) is poised to drive payment and delivery reform across the payer mix for the foreseeable future. (See sidebar: [Balancing innovation and regulation: The public sector's role.](#))

\* Our survey included 85 external respondents, including leaders from the biopharmaceutical industry, medical technology companies, diagnostics, health and nonhealth focused technology companies, venture capital investors, providers (Accountable Care Organizations, Integrated Delivery Networks, Academic Medical Centers, physician groups), urgent care, retail clinics, health plans, and nurse practitioners, clinical pharmacists, academics, and former policy makers.

- **Rise of consumerism:** Consumers' expectations for how they receive services—including health care—are changing. Consumers impatient with poor service are happy to transfer their loyalty to companies and products that deliver on cost and convenience. Health care consumerism is increasing, even as some health plans are shifting more cost-sharing to consumers, many of whom are struggling to make informed decisions due to a lack of available information on treatment options, quality, and price. Another aspect of consumerism is patient behavior, one of the key components of disease management amidst the increasing prevalence of chronic conditions. Successful patient engagement could improve self-care and help achieve better outcomes; many health care stakeholders are investing in solutions to address this issue. In addition, some researchers are trying to understand what motivates individual patients and are working on developing tailored solutions that incorporate individualized goals.
- **Data privacy, security, and interoperability:** Several new data sources are being discovered and created, generating a wealth of information on practice patterns, health, outcomes, and costs. Increasing data volume and variety are being partially fueled by the adoption of electronic health records (EHRs); however, much of the data is not yet interoperable, limiting the extent to which organizations can use it for research or incorporate it into clinician workflows. Further, health care stakeholders are concerned with protecting the privacy and security of patient data.

Health care leaders should identify which of the top 10 innovations are likely to impact their specific business models. For each innovation, we describe how it might break constraints to create "more for less," and what changes could support greater adoption.



### Balancing innovation and regulation: The public sector's role

The federal government can play a key role in health care innovation both by launching pilots and programs as well as evolving regulations to keep pace with emerging technologies and ideas. Regulators set metrics and measure outcomes, establish objectives, and create processes for stakeholders to follow. These rule sets can serve dual functions: While they set guidelines or rules for organizations to follow, they can also serve as catalysts for innovation. Several recent examples of federal health initiatives or policy changes, for example, could help the top 10 innovations realize their transformative potential:

- The Obama Administration is issuing regulations to implement new payment tracks under the **Medicare Access and CHIP Reauthorization Act of 2015 (MACRA)**, which is poised to drive health care delivery and payment reform across clinicians, health systems, Medicare, and other government and commercial payers. Congress intended MACRA to be a transformative law that fundamentally changes how physicians and other clinicians are reimbursed under the Medicare Physician Fee Schedule, and establishes new incentives that will drive payment and delivery reform efforts across the health care payer mix. MACRA has the potential to be a game-changer at all levels of the health care system. Already, the law is igniting strategic discussions around new care, payment, and delivery models and creating new sources of risk-sharing for health care organizations. MACRA's implementation could drive health care providers to experiment with new approaches to care delivery and patient engagement, including several of the innovations we describe in this paper.
- In 2015, the Administration announced the **Precision Medicine Initiative (PMI)** to improve health outcomes, fuel the development of new disease treatments, and catalyze a new era of data-based and more precise preventive care and medical treatment. The National Institutes of Health (NIH) is working to create a research cohort that will engage a million or more Americans who volunteer to contribute their health data over many years to help meet this goal. This registry will help researchers understand how genetic and nongenetic factors, such as the gut microbiome, patient behaviors, and the environment, could also influence patient outcomes.<sup>4</sup>
- In January 2016, President Obama announced the launch of the **National Cancer Moonshot Initiative (NCM)**. Led by Vice President Joe Biden, the initiative aims to make more therapies available to more patients, while also improving our ability to prevent cancer and detect it at an early stage.<sup>5</sup> Greater collaboration could result in additional investment and acceleration in research for new treatment approaches like immunotherapy. The NCM is also encouraging the research community to make data available and mineable by all.
- The Centers for Disease Control and Prevention (CDC) plays a leadership role in our nation's response to disease outbreaks like the recent Ebola outbreak and Zika virus. These kinds of global health crises can generate new ideas and bold solutions to problems that surface during an outbreak response. CDC teams across the globe are coming up with innovative ways to handle these unexpected challenges by creating better approaches and tools to fight epidemics. Specifically, they are leading vaccine trials, creating new uses for technologies, developing rapid diagnostics, and facilitating innovative partnerships.<sup>6</sup> For example, CDC labs have developed a test that can confirm Zika in the first week of illness or in a sample from an affected child.<sup>7</sup>
- The Energy and Commerce Committee's 21st Century Cures initiative and related legislation aim to modernize elements of the federal government's research and regulatory agencies to accelerate the pace of cures in America.<sup>8</sup> The initiative is focused on a broad range of issues, including a comprehensive process of basic science discovery, streamlining the drug and device development process, and using digital medicine and social media at the treatment and delivery phase. The legislation seeks to strengthen the federal agencies charged with advancing these areas, including NIH, the Food and Drug Administration (FDA), and CMS.<sup>9</sup>

As many of these initiatives gain momentum it is important to acknowledge that innovation and regulation can sometimes clash. It can be a challenge for regulatory agencies, policymakers, and governing bodies to keep up with the rapid evolution of technology and new and evolving threats to public health. Innovators should carefully consider how to operate in the heavily regulated health care industry. The public wants new, groundbreaking treatments and cures for our most perplexing diseases, but also wants them to be safe and accessible. Consumers want health care information at their fingertips, but also want assurance that their privacy is protected and their personal data secure. Society wants access to the best innovations, but there is a need to balance that with investments in infrastructure, education, and providing a safety net for our vulnerable citizens. The public sector strives to achieve this balance through increased coordination among agencies, public input, and public-private partnerships.

*"It can be a challenge for regulatory agencies, policymakers, and governing bodies to keep up with the rapid evolution of technology and new and evolving threats to public health."*



## Top 10 innovations

- ➔ Next-generation sequencing (NGS)
- ➔ 3D-printed devices
- ➔ Immunotherapy
- ➔ Artificial intelligence (AI)
- ➔ Point-of-care (POC) diagnostics
- ➔ Virtual reality (VR)
- ➔ Leveraging social media to improve patient experience
- ➔ Biosensors and trackers
- ➔ Convenient care: Retail clinics and urgent care
- ➔ Telehealth
- ➔ Popular innovations that didn't make the list

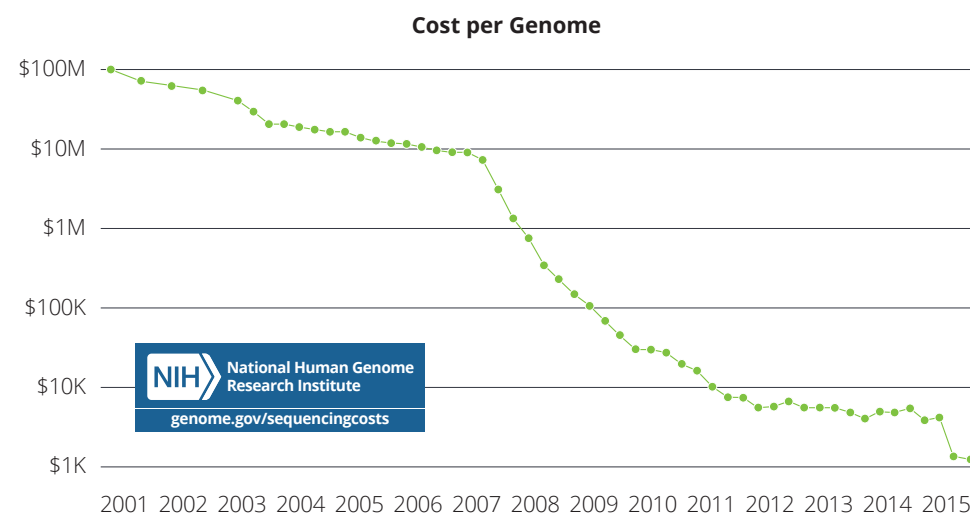


### Next-generation sequencing (NGS)

**More for less:** Advances in genetic sequencing could lead to the development of diagnostic tests that may identify at-risk populations where early interventions could save downstream health care costs. 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 \$3 billion. 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 \$1,000 (Figure 1).<sup>10</sup>

**Figure 1. Decreasing genome sequencing costs<sup>11</sup>**



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

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.

For NGS to realize its potential, innovators will likely need to:

- Demonstrate the accuracy, reliability, and clinical validity (the ability of a test to accurately predict the condition or risk of disease) of diagnostic tools;<sup>12</sup>
- Demonstrate improvement over the current standard of care and cost-effectiveness to receive reimbursement;
- Understand and comply with requirements to protect patient information that, by its nature, cannot be de-identified.

**Use case:** Specific tumor receptors can be indicative of genetic causes of disease. For example, a positive BRCA1/2 test in a breast cancer patient could indicate that the patient is at higher risk of recurrence and malignancies. Awareness of the increased risk may alter the patient's treatment plan. Further, it could prompt physicians to conduct genetic screening for at-risk relatives.<sup>13</sup>

### 3D-printed devices

**More for less:** Manufacturers and providers could use 3D printing to create highly customized, low-cost medical technology products that can be tailored to suit the physiological needs of individual patients.

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).<sup>14</sup> Other applications, such as 3D-printed prosthetics, offer more customized 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 customization and reduces waste. For example, the airway splints for babies with tracheobronchomalacia can be made in a matter of hours and cost about \$10 per unit.<sup>15</sup>

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 minimized.

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.<sup>16</sup>

Greater adoption of 3D-printed medical devices will likely depend on the:

- Ability of innovators to demonstrate biocompatible products' safety;
- Development of a consistent reimbursement framework, likely requiring prospective clinical trials to determine cost-effectiveness;
- Willingness for providers (beyond academic medical centers) to invest in 3D-printing equipment.

**Use case:** Close to 200,000 amputations are performed each year in the US. Prosthetics can be priced from \$5,000-\$50,000, creating access challenges for patients.<sup>17</sup> One company, Open Bionics, is an open-source initiative for the development of 3D-printed hands and arms. Open Bionics prosthetics are offered to amputees at a much lower cost than traditional prosthetics, ranging from \$100-\$200.<sup>18</sup>

### Immunotherapy

**More for less:** Immunotherapies have the potential to significantly extend survival for cancer patients, without the negative side effects and associated health care costs of traditional chemotherapy.

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.<sup>19</sup>

- **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 recognized 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.<sup>20</sup>

- **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 percent. 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 individualized responses make further research challenging.<sup>21</sup>
- Develop a scalable manufacturing process. The use of CAR-T is limited to specialized labs where clinicians are trained to handle risks and potentially life threatening adverse reactions.
- Demonstrate evidence of significant improvement over the standard of care, and long-term efficacy to gain reimbursement. Some immunotherapies have shown efficacy in combination with other therapies, with high treatment costs reaching above \$250,000.

**Use case:** Early studies show that CD-19-targeted chimeric antigen receptor therapy treatments from Juno and Kite provide response rates hovering around 90 percent for patients with multiple relapsed or refractory acute lymphoblastic leukemia. Patients from some of these trials have experienced greater than one-year remissions with persistence of CAR-T cells.<sup>22</sup>

### Artificial intelligence (AI)

**More for less:** AI, the ability of computers to think like humans, is anticipated to transform health care by completing tasks currently performed by humans with greater speed and accuracy, and using fewer resources.

Within health care, 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 percent of US hospitals and insurance companies will implement AI systems by 2025.<sup>23</sup>

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;
- Health care professionals' and patients' acceptance and trust of AI tools.

**Use case:** Watson Oncology is an AI solution that helps oncologists keep up with the field's rapidly expanding evidence base. A collaboration of IBM and Memorial Sloan Kettering, Watson Oncology provides individualized treatment options for patients based on their specific case details and existing clinical evidence. The technology will assist oncologists with the challenging task of synthesizing the latest research and best available information to improve patient care.<sup>24</sup>

“AI has the potential to improve the accuracy, precision, and timeliness of patient diagnoses.”

### Point-of-care (POC) diagnostics

**More for less:** POC diagnostics allow for convenient and timely testing at the point of care, resulting in faster, more cohesive, and less-expensive patient care.

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, among 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 \$3 billion in 2021, up from \$2.13 billion in 2015.<sup>25</sup>

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;
- Health care 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.

**Use case:** Kardia is a device that enables consumers to track and analyze their heart health. Frequently, by the time a patient with heart arrhythmia arrives at the ER or physician office, their heartbeat returns to normal, making it difficult to diagnose the problem. Kardia takes a medical-grade electrocardiogram in 30 seconds and shares it with physicians, capturing irregular heartbeats when they occur. The mobile device connects to smartphones and tablets and is also available in a band for the Apple Watch® wrist band.<sup>26</sup> Users have commented that it “brings peace of mind.”<sup>27</sup>

“Providing test results when patients are receiving care speeds diagnoses, increases care efficiencies and, potentially, decreases costs associated with delayed treatment.”

## Virtual reality (VR)

**More for less:** Virtual reality can engage patients in low-risk, artificially-generated sensory experiences that could accelerate behavior change in a way that is safer, more convenient, and more accessible to the consumer.

VR creates multisensory experiences using computer-generated images that appear on a headset. In health care, 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 behaviors to improve wellness, such as weight management and smoking cessation.<sup>28,29</sup> 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.<sup>30</sup> 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 health care (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.<sup>31</sup>

As with many technologies, the notion of virtual reality is decades old but its commercial realization has been subject to the sometimes slow pace of technological progress. Screen and processor technology have only recently improved in terms of price and performance such that VR is commercially viable, though the price may still be too high for widespread adoption.<sup>32</sup> In the future, VR could be integrated with technology advances such as AI, sophisticated bio-sensors, 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.

**Use case:** VR is being used to help some soldiers with post-traumatic stress disorder (PTSD). Clinics and hospitals are using VR warfare simulations akin to conditions in Iraq and Afghanistan to help veterans who are, in many ways, continually reliving the traumatic events they experienced. In a safe and controlled environment, the soldiers can learn how to deal with instances that might otherwise be triggers to behavior that could be destructive to themselves and others.<sup>33</sup> Facebook's Oculus Rift is experimenting with exposure therapy, where a patient can experience driving a Humvee down a desert road or mountain pass or recreating an improvised explosive device blast or attack.<sup>34</sup> The VR experience allows the patient to pace the exposure in a more controlled fashion that engages the user and enables the clinician to guide therapy.



According a recent Deloitte Touche Tomatsu Limited report, 2016 is expected to be the first billion dollar year for VR, with **\$700 million** in hardware sales and **\$300 million** from content.



The main usage for VR is video games on smartphones, tablets, game consoles or PC.

Source: Deloitte Touch Tomatsu Limited, "Virtual reality: a billion dollar niche," 2016.





### Leveraging social media to improve patient experience

**More for less:** Social media offers health care organizations a potentially rich source of data to efficiently track consumer experiences and population health trends in real time, much more efficiently than current approaches.

Just as retailers are using customer data to promote specific products, the health care 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 health care 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 Center for Health Solutions *2015 Survey of US Health Care Consumers* found that 52 percent of consumers actively search online for health- or care-related information. Patient-generated content on these digital platforms illustrates the needs, wants, motivations, behaviors, 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.

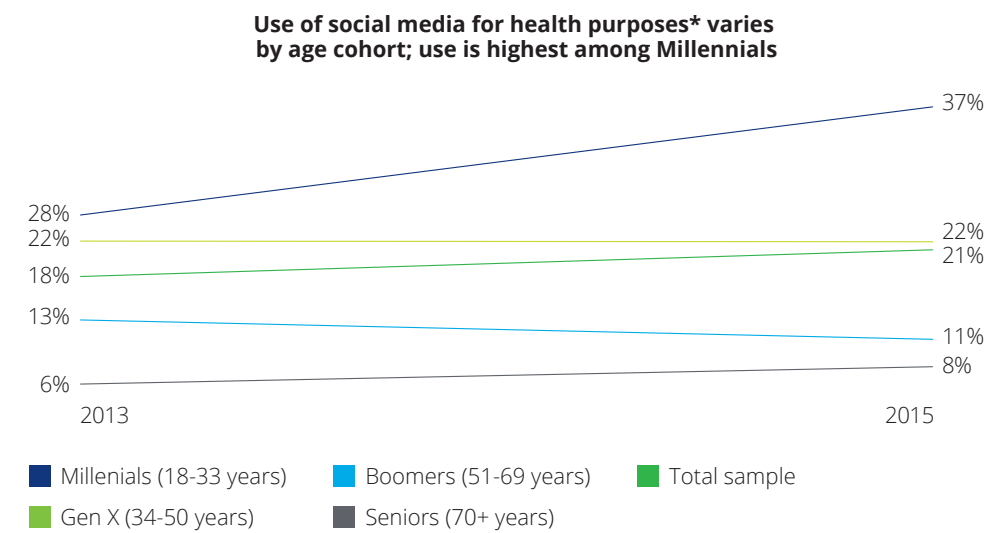
Social media also can be used to track consumers' experiences with the health care system. Research has focused on leveraging broad population data such as looking for certain terms on Twitter or other platforms, or using focused disease communities to learn about patient preferences, symptoms, responses to treatment, and other quality-of-life measures.<sup>35</sup>

Several well-established surveys capture patient experience with the health care system, but it takes several months to publish results, and response rates are typically low. Greater use of social media generated lifestyle and behavioral data may help to measure patient experience with less of a lag-time than these traditional survey methods. In addition, a recent Deloitte report, *“Developing mission-critical social listening programs for pharmaceutical companies,”* showed that these companies could make better use of their social media channels to understand how, when, and why patients and caregivers are sharing experiences with specific drugs, therapies, diseases, and condition.<sup>36</sup>

Health plans, providers, and life sciences companies would likely need a better understanding of several factors to increase adoption of social media listening strategies:

- Whether patients who are willing to share information on social media are different—demographically or clinically—from non-sharers (Figure 2);
- What insights may be available from a database that merges social media and electronic medical record data;
- Which methods can control for data that may be inaccurate or mischaracterized.

**Figure 2. Use of social media for health purposes by age cohort**



\*Health purposes include learning more about and/or sharing personal experience with a specific illness, injury, or health problem; specific prescription medications or medical devices; specific doctors or hospitals; the health care system in general; health technologies that can help you diagnose, treat, monitor, or improve your health; or other health- or care-related purposes.

Source: Deloitte 2015 Survey of US Health Care Consumers.

**Use case:** In the past year, several studies have looked at smartphone data and social media use to study various health issues, including predicting symptoms of depression and learning about patient experience and behavioral epidemiology of sleep disorders. Researchers at the University of Arizona have combined Twitter posts with air quality and hospital data into a model that predicts ER trends for asthma better than existing disease surveillance models.<sup>37</sup> The team combined Twitter keywords, air quality data from the Environmental Protection Agency, and emergency department data from a hospital in Dallas and found a correlation between tweets about asthma, changes in air quality, and asthma-related ER visits. Twenty-five million Americans have asthma and there are two million asthma-related ER visits in the US each year. An ongoing challenge for hospitals is predicting how many people with chronic conditions will come to the ER on any given day. This model uses data to help make those predictions and can anticipate ER visits with 70 percent precision.

### Biosensors and trackers

**More for less:** Biosensors included in rapidly shrinking wearables and medical devices allow consumers and clinicians to monitor and track more aspects of patients' health, enabling earlier intervention—and even prevention—in a way that is much less intrusive to patients' lives.

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.<sup>38</sup>

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.

Wider adoption of biosensors and trackers would likely require:

- Improvements in the technologies' accuracy, although some clinicians have noted that trend data is usually helpful, even if specific data points are not completely accurate;
- Biosensor and tracker interoperability with EHRs;
- Patient and provider willingness to incorporate these devices and data into daily routines; and
- Transition to VBC payment models, which would create opportunities for clinicians to indirectly receive reimbursement for the time and costs of accessing and evaluating this new data set.

**Use case:** Profusa is developing tissue-integrated sensors to help individuals continuously monitor their body chemistry. The Lumee biosensor consists of a biosensor that is made of material similar to contact lens and is integrated into the body's tissue. An external optical reader tracks signals from the biosensor and sends the data to a smartphone. Applications will focus on peripheral artery disease initially, with plans to expand to diabetes; chronic obstructive pulmonary disease; and prevention, wellness, and fitness uses.<sup>39</sup>

### Convenient care: Retail clinics and urgent care

**More for less:** Retail clinics and urgent care centers provide more convenient and lower-cost health care to patients.

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 centers 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 behavioral counseling, care coordination, and infusion centers, their impact may increase.

According to the Deloitte Center for Health Solutions *2015 Survey of US Health Care Consumers*, 77 percent of respondents choose retail clinics for their convenience, 72 percent for speed of securing an appointment, and 60 percent for after-hours care.

Greater utilization of these lower-cost care centers would likely require:

- State regulators' expansion of the scope of services for nonphysician providers, including pharmacists and nurse practitioners;
- Health plan reimbursement for those services, either through traditional FFS or through VBC models in partnership with provider organizations; and
- Retail clinic and urgent care center care coordination and demonstration of equivalent or superior care quality.

**Use case:** With over 400 locations across the US, Walgreens health care clinics offer same-day appointments and walk-in visits for services including vaccinations; health screenings; and treatment of illness, aches and pains, minor injuries, and skin conditions. In 2013, Walgreens was the first retail clinic to offer management of chronic conditions including asthma, diabetes, high blood pressure, and high cholesterol.<sup>40</sup> Walgreens recently announced its collaboration with Mental Health America, a national behavioral health advocacy organization.<sup>41</sup> Walgreens will provide mental health screenings online as well as train its clinicians to better identify mental health conditions.

### Telehealth

**More for less:** Telehealth offers a more convenient way for consumers to access care while potentially reducing office visits and travel time. This convenient care model has the potential to increase self-care and prevent complications and ER visits.

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 health care and patient and professional health-related education. Telehealth lets health care 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.<sup>42</sup>

For health care organizations 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, organizations have shown that through a targeted approach, especially to certain high-risk populations who are covered under VBC models, telehealth programs can be cost-effective.<sup>43</sup> 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 programs for noninstitutionalized care patients with chronic conditions, and the studies show that the programs have resulted in sizable declines in several health care cost drivers (e.g., ER visits and admissions).<sup>44</sup> In addition, individuals who would have long-term or frequent hospital admissions are able to live independently in their homes.

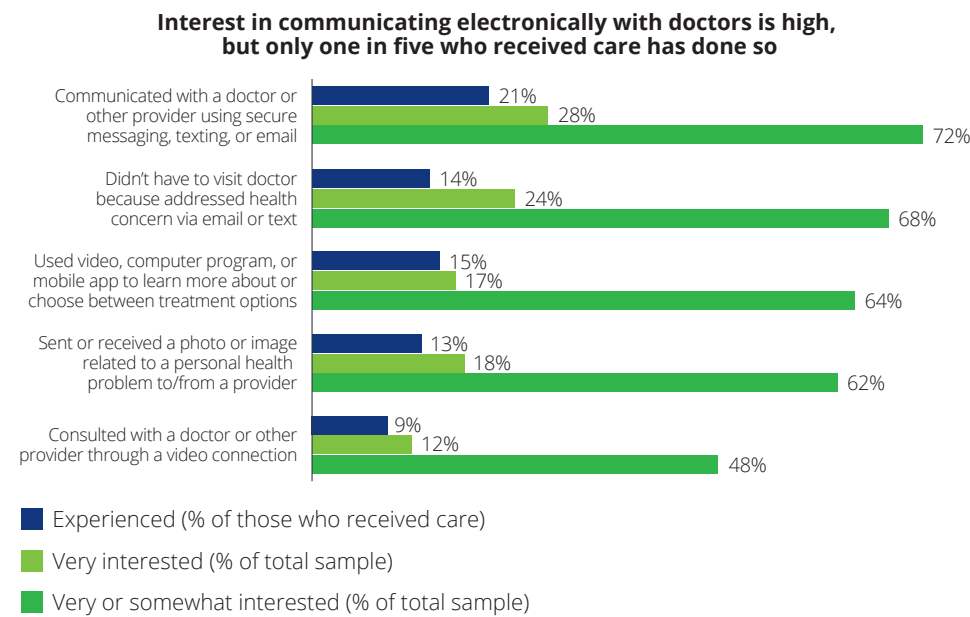
Although telehealth technology is not new, provider use remains low. Some current/pending marketplace changes that may encourage greater provider adoption of telehealth include:

- Provider participation in value-based payment models;
- Increasing patient willingness to leverage technology to facilitate a relationship with their clinician (see current level of interest in using technology in Figure 4);
- Flexibility in government policies to allow practitioners to practice across state lines.

**Use case:** American Well is working to make online doctor visits accessible for one-off care issues such as colds or infections, and chronic care management including diabetes and depression. The care delivery model involves working with health plans, employers, and health systems, as well as their telehealth app, Amwell.

American Well is collaborating with several providers to implement its services. American Well is rolling out a service that will provide urgent care services to patients using online video. Patients experiencing nonemergency medical conditions can connect to board-certified physicians from American Well's nationwide medical affiliate. The service features high-definition video that is available 24 hours a day, seven days a week through a mobile app, tablet, or computer with Internet access. The company says that the service will cost \$49 and includes physician review of information, development of a treatment plan, medication prescriptions, if necessary, and suggested follow-up care.<sup>45</sup>

**Figure 4. Consumer interest in communicating electronically with doctors is high<sup>46</sup>**



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

**Popular innovations that didn't make the list**

Recent buzzworthy reports about innovation have tended to focus on “shiny objects,” or technologies that have been the focus of a lot of recent hype. Many technologies that fall into this category represent “more for more”—advancements that typically come at a higher cost, either financially or physically in the case of health care. It is possible that with further research and advances some of the innovations described below could become “more for less” but they did not make the top 10 list. Nominated technologies that do not yet meet our definition of innovation include:

- Gene therapy**—Gene transfer technology involves inserting genes into living cells to enhance the body’s own response to complex diseases or to provide specific proteins that are lacking in the patient. In most gene therapy studies, researchers use a carrier molecule called a vector to deliver the therapeutic gene to the target cells. Early candidates for gene therapy are rare genetic diseases associated with significant disability and early mortality with limited or no therapeutic options. However, treatment costs can exceed \$1 million and there is limited data on the long-term safety and efficacy. Reimbursement for these treatments will likely require demonstrable data that the benefits are sustainable and there are minimal negative effects for the patient. Without such data, gene therapy is not likely to be incorporated into clinical practice at a scale that will transform health care.
- Regenerative medicine**—Regenerative medicine describes the use of human cells to rejuvenate, replace, or regenerate human tissues. This technology has the potential to transform care by replacing some biopharmaceuticals and medical prostheses. For example, if regenerative medicine was successful in replacing B-islet cells in the pancreas, it could negate the need for a patient to receive insulin injections. Cartilage regeneration could replace the need for certain prostheses. However, it is unclear how expensive these products will be, or if they will be significantly better than the standard of care. Further, ethical concerns around the use of stem-cell-based therapies remain. Until these issues are resolved this technology is not likely to be adopted into clinical practice.

- Robotics**—Robotics has the potential to take over many of the mundane or unsafe health care-related tasks that humans currently perform and increase the efficiency of these tasks. For instance, robotics could improve drug compounding preparation, decontaminate and sterilize medical equipment, and reallocate personnel resources to more high-value areas (e.g., allow nurses to spend more time directly with patients). Driverless cars could take patients to their appointments, improving continuity of care. Drones could pick up medication that an elderly patient may have dropped on the floor. Robotic applications in pharmacies and surgery are being used today, though the full potential of the technology has not yet been reached. The cost of these technologies remains a challenge in some applications (e.g., surgery), and it is unclear if leveraging robotics will improve efficiencies and outcomes enough to justify the additional cost.



# Embracing innovation: Next steps

These top 10 innovations have the potential to transform the health care system at large but each organization will be impacted to different degrees depending on its core strategies, offerings, and goals. Health care leaders should focus on innovations that have the potential to positively impact their specific business models. Regardless of where leaders choose to focus first, there are several next steps that they should consider:

- **Build ecosystems:** Adopting many of these innovations requires capabilities that fall beyond the traditional purview of health care organizations. They should identify partners which can complement their existing capabilities or fill gaps. Some of these complementary capabilities could include technology development, data capture, or patient engagement.
- **Embrace nontraditional sources of knowledge:** The democratization of innovation and the rise of the makers movement, where individuals or groups of individuals use existing materials to build solutions to health care's challenges, could create new sources of knowledge and talent. Organizations might consider looking outside their walls and crowdsourcing fresh ideas to challenging problems.
- **Pilot, experiment, and scale:** Given the rapid pace of change, organizations would benefit from embarking on small-scale pilots before entering into full-scale contracts with new technology providers. Small-scale pilots would allow organizations to experiment with new approaches or technologies. If they are successful, then expand to scale. If not, then quietly pivot to adjust the strategy.
- **Experiment with new business models:** Traditional health care business models are changing and, as a result, organizations could benefit from expanding beyond traditional revenue sources. Many health care organizations are growing venture capital investments or engaging in joint ventures with nontraditional partners.
- **Focus on change management:** Many times an organization knows it needs to change and wants to do so but simply doesn't have the ability. This is evident in the low success rate of many transformational initiatives. Successful change requires dedicated focus and effort.
- **Be agile:** Leading organizations should learn to anticipate and swiftly address emerging innovation. They should disrupt their own business models before someone else does.

“Health care leaders should focus on innovations that have the potential to positively impact their specific business models.”

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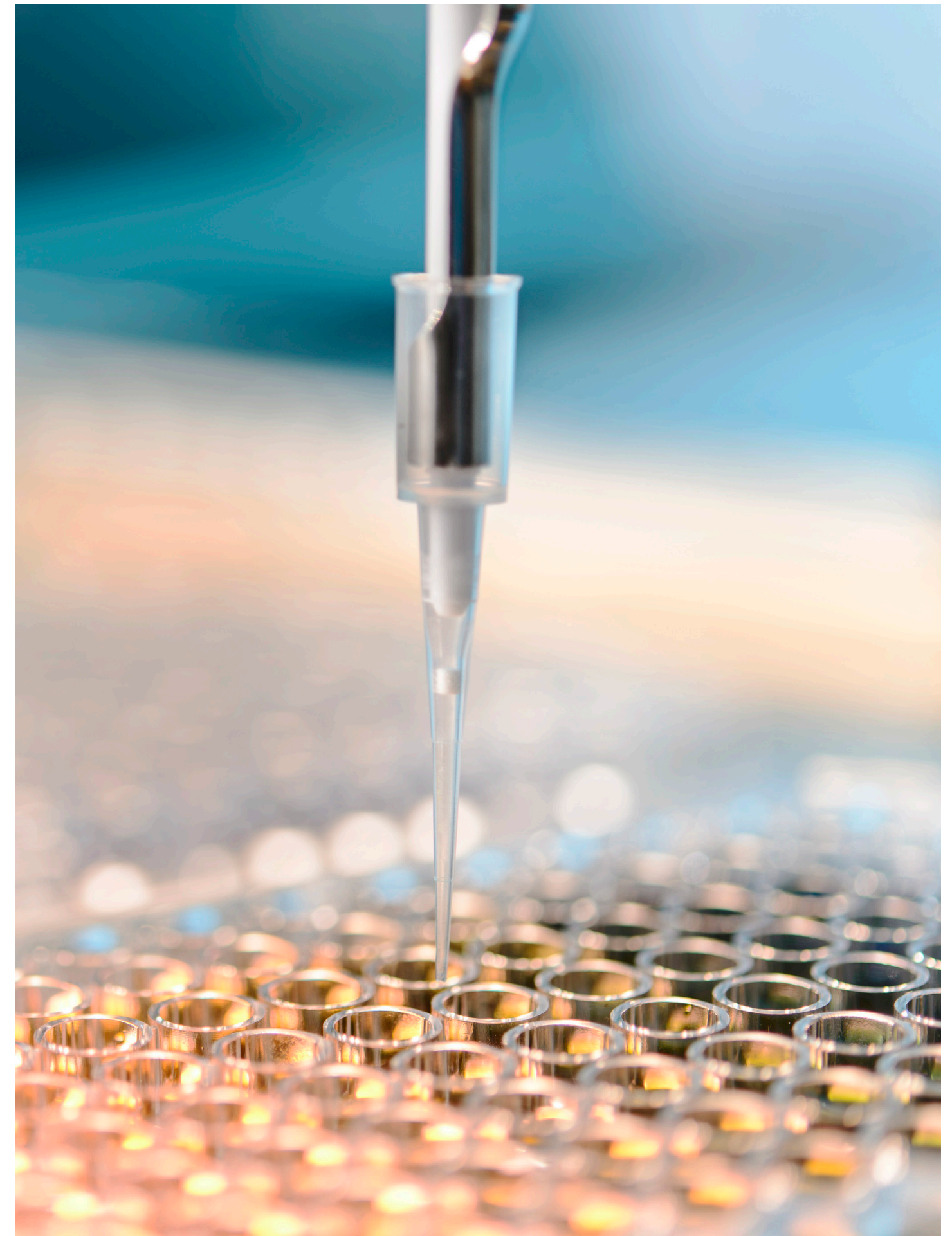
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