



Digital Transformation in the Health Care Environment

The industry perspective

Makis Papataxiarchis

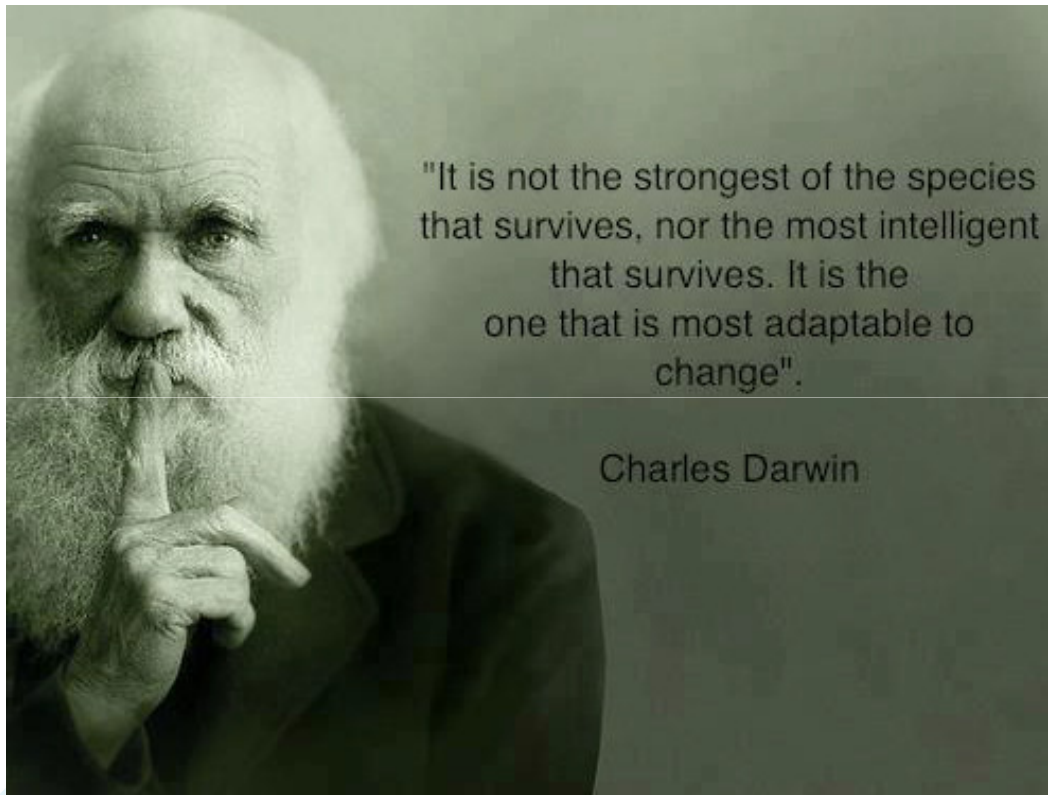
Managing Director, Janssen Greece, Pharmaceutical companies of Johnson & Johnson

Chairman, Pharmaceutical Companies Committee, American-Hellenic Chamber of Commerce

President PhRMA Innovation Forum

Athens, Friday 21 June 2019

Fostering a Culture of Change



"It is not the strongest of the species that survives, nor the most intelligent that survives. It is the one that is most adaptable to change".

Charles Darwin



Key messages from internal and external analysis



Service models are evolving towards creating platforms that are enabled by technology

Technology trends



Smart systems



Data storage and analysis



Real-time interactions



Mobile devices



AND

Analysis of companies

Evolving service models



Service platforms for peer-to-peer learning and sharing



Platforms to combine free and paid offerings to build brand



Aggregation platforms that simplify and remove marketplace frictions

Technology landscape analysis



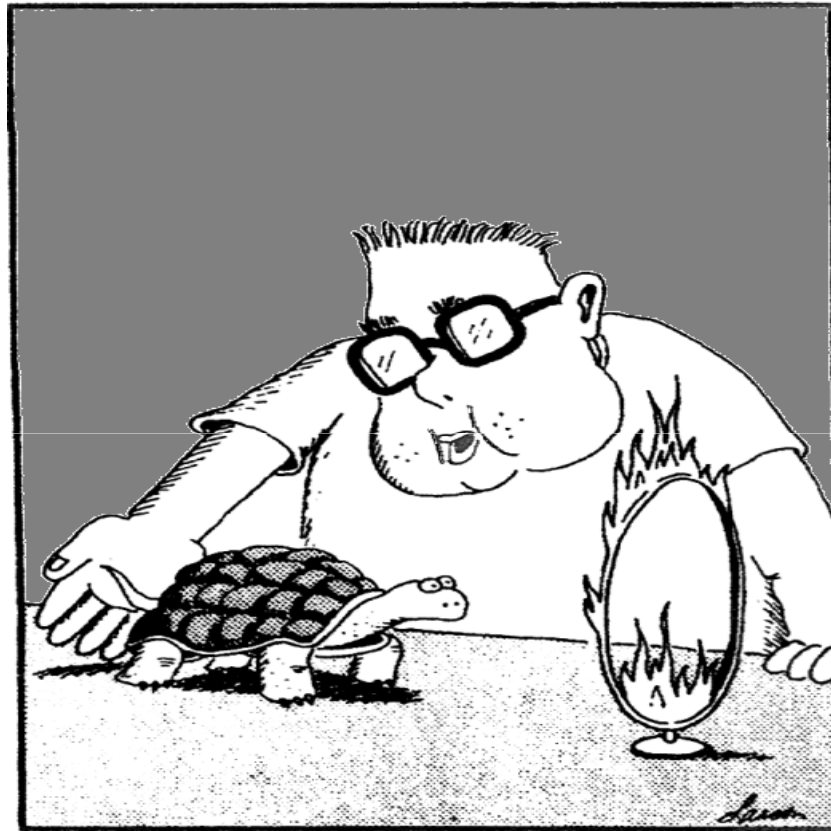


Globalization

Multicultural, Multitasking, Diversity & Inclusion

Erudition, Learning Agility





“Through the hoop, Bob! Through the hoop!”

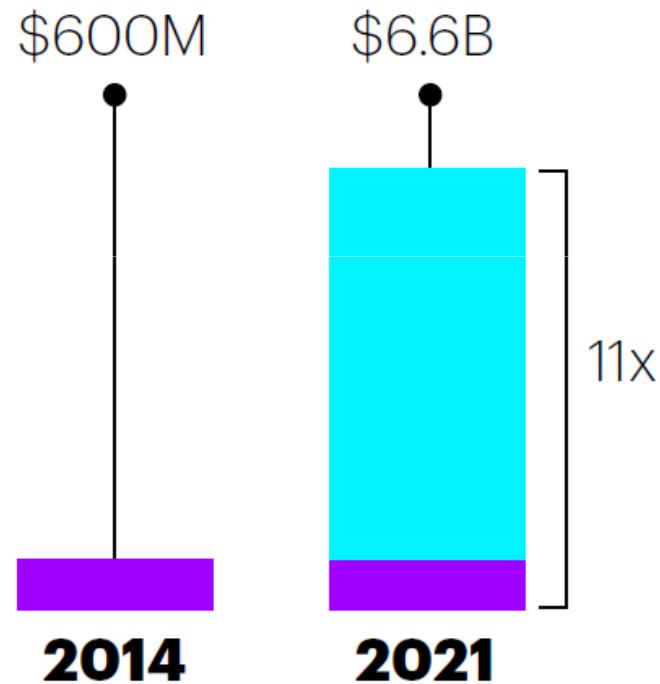
ARTIFICIAL INTELLIGENCE: Healthcare's New Nervous System



AI health market is seeing explosive growth

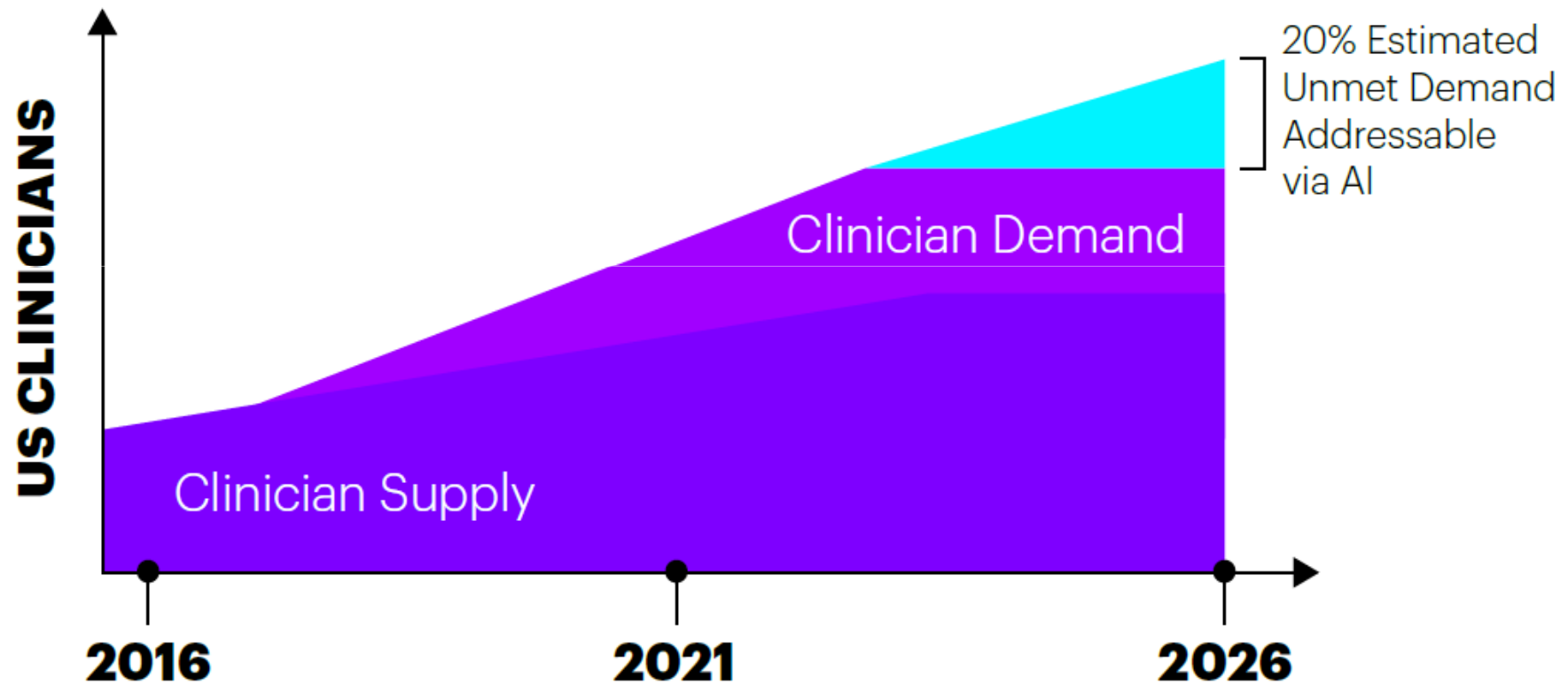
HEALTH AI MARKET SIZE 2014-2021

Acquisitions of AI startups are rapidly increasing while the health AI market is set to register an explosive CAGR of 40% through 2021



Source: Accenture analysis

AI can address unmet clinical demand



Source: Accenture analysis. Graph is not to scale and is illustrative.

**Last
decade**

Medical Products

Equipment, Hardware,
Consumables



Differentiation is solely through product innovation. Focused on historic and evidence based-care.

**Current
decade**

Medical Platforms

Wearable, Big Data,
Health Analytics



Differentiation by providing services to key stakeholders. Focused on real time outcome based-care.

**Next
decade**

Medical Solutions

Robotics, AI,
Augmented Reality



Differentiation via intelligent solutions for evidence/outcome based health. Focused on preventive care.

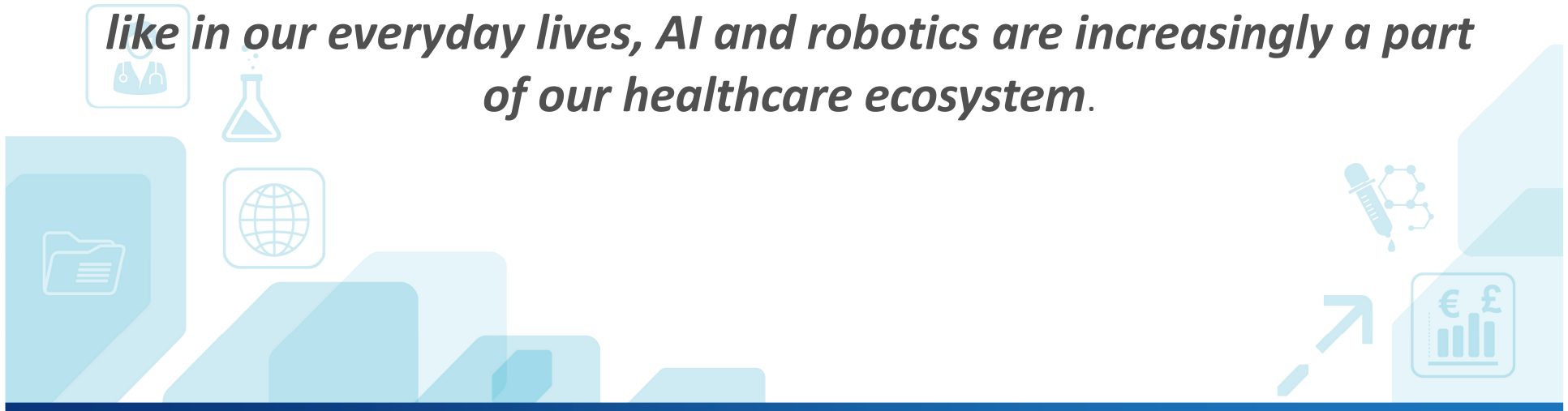
Source: Frost & Sullivan, 'Transforming healthcare through artificial intelligence systems', 2016

1 The Medical Futurist (2016). <http://medicalfuturist.com/artificial-intelligence-will-redesign-healthcare/>. 2 Healthcare Data Institute (2015). <http://healthcaredatainstitute.com/2015/02/18/big-unstructured-datas-contribution-to-healthcare/>. 3. PwC (2016). Care Anywhere: Moving health and wellness out of the hospital and into the hands of the consumer. <https://www.pwc.com/m1/en/publications/documents/care-anywhere.pdf>

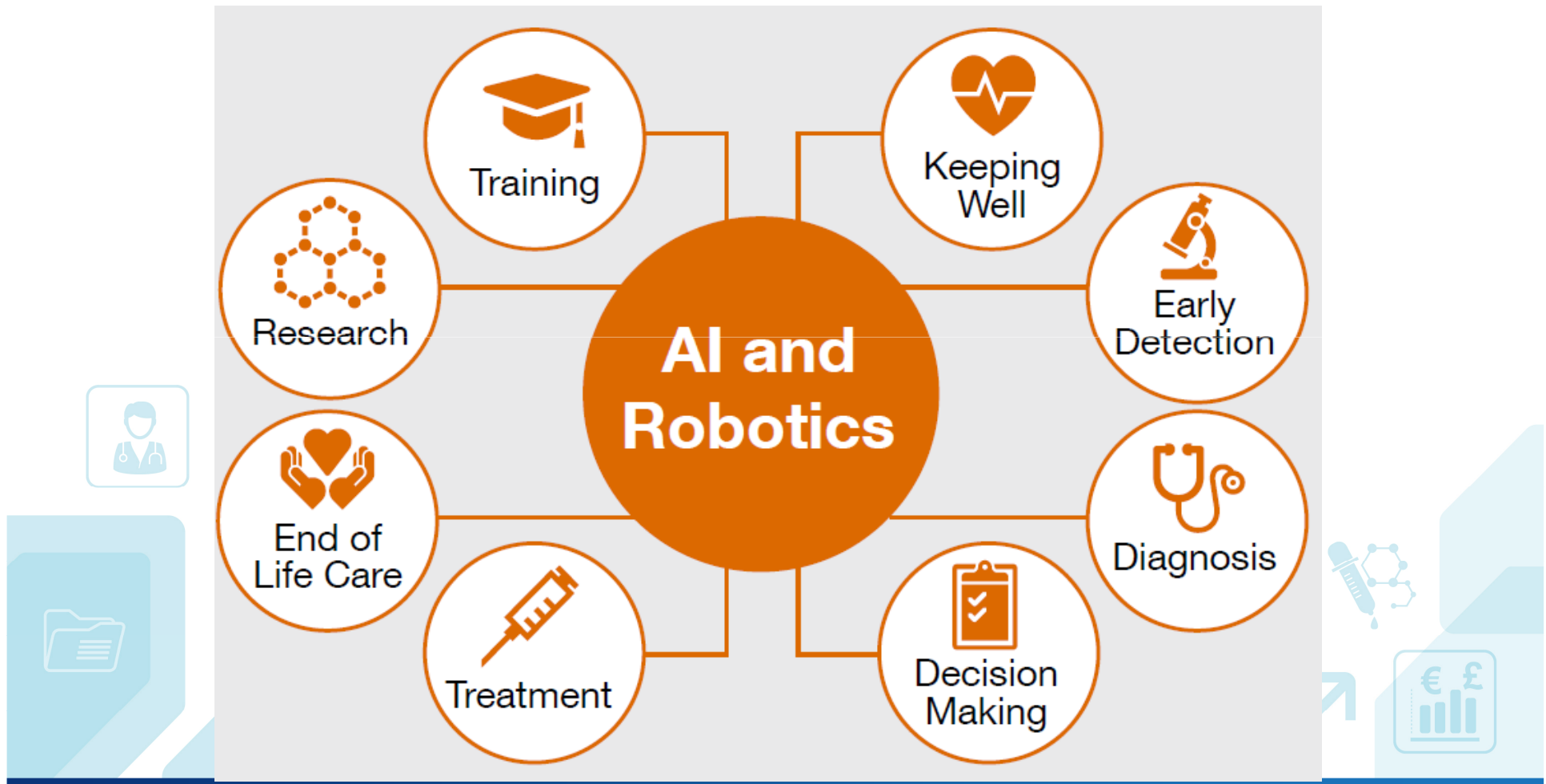
No longer science fiction, AI and robotics are transforming healthcare

AI is getting increasingly sophisticated at doing what humans do but more efficiently, more quickly and at a lower cost.

The potential for both AI and robotics in healthcare is vast. Just like in our everyday lives, AI and robotics are increasingly a part of our healthcare ecosystem.



No longer science fiction, AI and robotics are transforming healthcare



Artificial Intelligence Market for Healthcare Applications, World, 2014, 2021



Source: Frost & Sullivan 2016 Transforming healthcare through artificial intelligence systems

The value of medicines to patients, healthcare systems and society

PATIENTS

Patients live longer, healthier, more productive lives

ECONOMIES

The biopharmaceutical industry generates essential economic value in terms of job creation, R&D investment, and medications that improve patient productivity

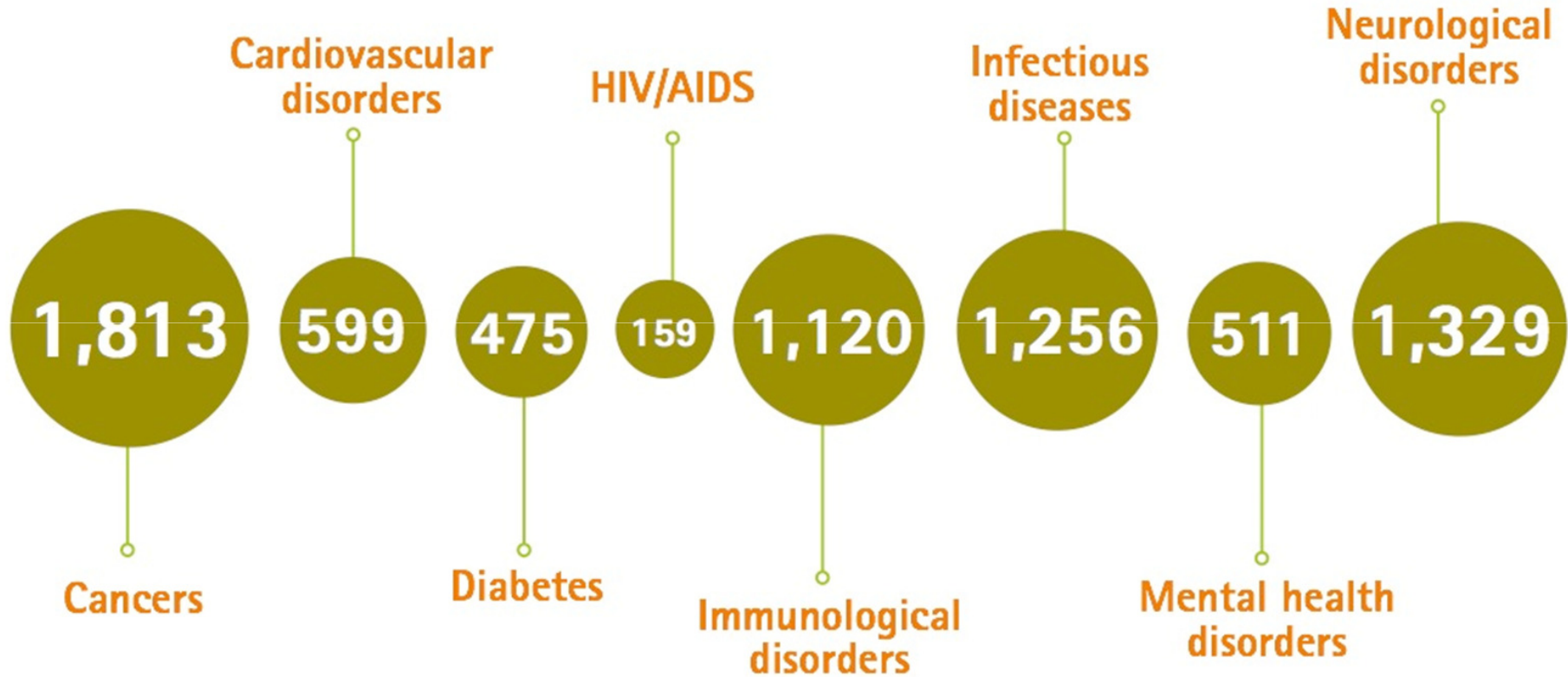
HEALTHCARE SYSTEMS

Innovative medicines can put healthcare systems on a more sustainable path by reducing costs in other parts of the healthcare system such as hospitalisations

SOCIETY

Society benefits from health and wellness as individuals are able to continue being productive members of the community

With over 7000 medicines in development, the exciting new wave of medical innovation will play a key role in addressing the challenges faced by patients and healthcare systems



Source: Health Advances analysis; Adis R&D Insight Database, March 2015, compiled by PhRMA

Can Artificial Intelligence Change How We Discover Drugs?



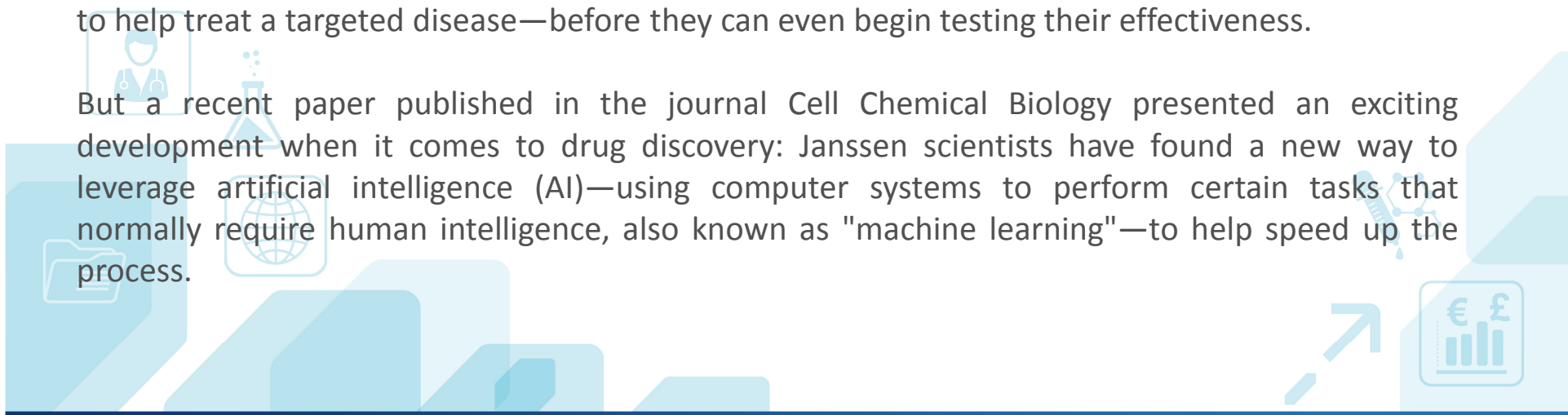
Yes—according to new research from scientists at Janssen who've found a way to speed up the drug discovery process using AI.

Janssen Research & Development, part of the Johnson & Johnson family of companies, has been at the forefront of treatment innovation for decades.

In fact, Dr. Paul Janssen, the Belgian physician who founded his eponymous company in 1953, discovered and developed dozens of lifesaving medications throughout his career.

Traditionally, the process of discovering new pharmaceuticals takes years, due to the vast amount of data scientists must comb through to first identify the chemical compounds that are most likely to help treat a targeted disease—before they can even begin testing their effectiveness.

But a recent paper published in the journal *Cell Chemical Biology* presented an exciting development when it comes to drug discovery: Janssen scientists have found a new way to leverage artificial intelligence (AI)—using computer systems to perform certain tasks that normally require human intelligence, also known as "machine learning"—to help speed up the process.



How AI Is Reinventing Drug Discovery

In a typical drug discovery experiment, cells representing a specific disease, such as lung cancer, are exposed to a variety of compounds, and a microscopy snapshot is taken of each reaction that follows.

One such experiment might generate half a million snapshots. Scientists commonly use AI to help sort through them, with the goal of finding a compound that could create the desired reaction for the disease they are studying.

However, there hasn't been a way to use the data gathered from those snapshots to inform later experiments for other diseases. Realizing how valuable it would be to recycle these learnings, Janssen researchers teamed up with academic partners from leading European universities to develop computer algorithms that scientists can now use to predict how other types of cells will likely react to the same compounds, giving them a leg up when starting a new study.

"We no longer have to start from scratch every time," explains Hugo Ceulemans, Scientific Director, Discovery Sciences, Janssen Research & Development, and a senior author of the study.

In fact, Ceulemans and his team found this AI method to be up to 250 times more efficient than the traditional method of drug discovery.

"There's so much unmet need out there when it comes to medications," Ceulemans says. "Our algorithms can help us better mine our information to find better treatments faster."

Precision Medicine Definition and Methodology

Precision Medicines are medical treatments personalized to the characteristics of each patient by stratifying individuals into subpopulations that differ in their susceptibility to a particular disease or their response to a specific treatment

- Stratified medicines providing differential treatments
 - **tailored to specific groups of patients;**
- individuals within the group receive identical treatment.

- Personalized medicines providing differential treatments
 - **tailored to individual patients** based on their specific genome



•Review all medicines with a recommendation or requirement on their label for testing of a specific gene, protein or hormone prior to use in either the United States, Canada, Japan or Europe.

•Include products where testing of viral genotype is in general conducted prior to use (e.g., hepatitis C).

•Identify gene or cell based therapies that can alter genetic information in specific cells in individual patients to treat or prevent disease based on secondary research.



Innovation, precision and disruption

New business models for the future of healthcare



novel targeted therapies, improved artificial intelligence for therapy selection, wearables to better track personal health metrics

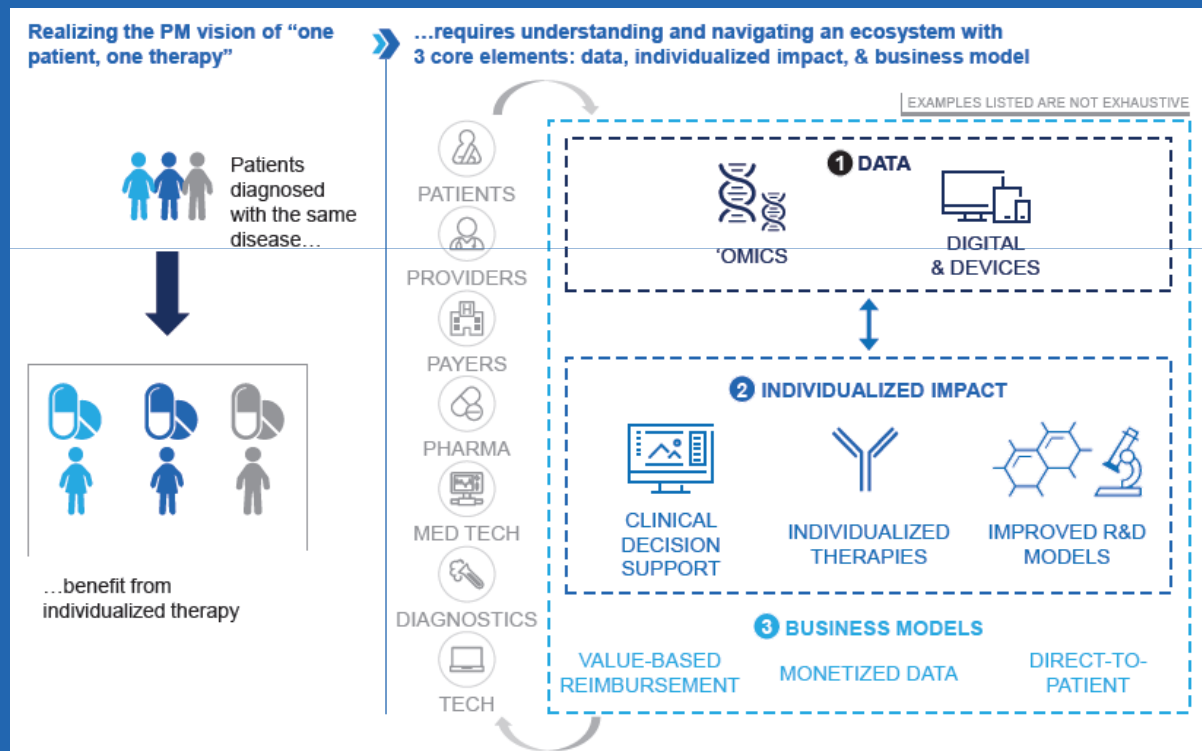
expectations on the part of patients, consumers,, providers, pharma and MedTech payers etc



Precision Medicine is ushering in rapid change for the healthcare industry

Healthcare Ecosystem

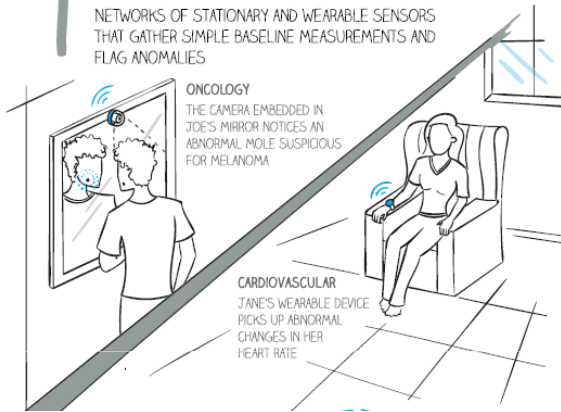
Acceleration of data generation, advances in developing insights, and personalization of the healthcare ecosystem have added dimensionality to precision medicine



Continuous learning based on ubiquitous data enables each patient to benefit from insights generated by the collective experience of the entire medical community

1 UBIQUITOUS SENSORS

NETWORKS OF STATIONARY AND WEARABLE SENSORS THAT GATHER SIMPLE BASELINE MEASUREMENTS AND FLAG ANOMALIES



2 STANDARDIZED DIAGNOSIS

SAMPLES AND DATA FROM ADVANCED OMICS AND NON-INVASIVE TESTS ARE COLLECTED USING A STANDARDIZED MASTER PROTOCOL INCLUDING KEY METADATA TO ENSURE COMPARABILITY



3 DATA PLATFORM

STANDARDIZED RESULTS ARE CONTINUOUSLY STREAMED THROUGH A SECURE, HIPAA-COMPLIANT NETWORK TO AN INTEGRATED DATA STORAGE AND COMPUTATIONAL PLATFORM



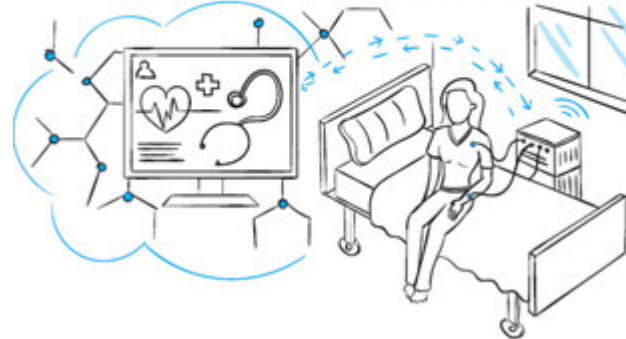
4 IMPACT GENERATION

THE PLATFORM AGGREGATES THESE DATA AND USES ADVANCED MACHINE LEARNING ALGORITHMS TO COME UP WITH DIAGNOSIS, PROGNOSIS, AND OPTIMAL TREATMENT PLANS FOR EACH PATIENT



5 CONTINUOUS FEEDBACK

PATIENTS ARE CONTINUOUSLY MONITORED AND THEIR OUTCOMES DATA ARE USED TO ADJUST TREATMENT PLANS AND INFORM TREATMENT ALGORITHMS FOR FUTURE PATIENTS



6 ACCELERATED DISCOVERY

RESEARCH AND DRUG DEVELOPERS USE THIS RICH SOURCE OF INTERCONNECTED DATA TO DRAMATICALLY IMPROVE EFFICIENCY BY RAPIDLY TESTING HYPOTHESES



Source: Copyright © McKinsey & Company, Pharmaceutical and Medical Practice 2018

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PHARMACEUTICAL COMPANIES
OF *Johnson & Johnson*

Diagnostics and Precision Medicine can improve outcomes across the entire patient journey



Generally complementary Dx

Generally companion Dx

Generally complementary Dx

Used to complement traditional risk factors

Used in high risk patient populations to identify disease early




Used for definitive diagnosis of disease

Assess severity of disease and overall outlook

Used to predict efficacy or safety response to specific treatments

Monitoring for treatment efficacy or safety and overall disease progression

Progress toward the future vision of precision medicine

	Recent Progress	Remaining Challenges	Critical Enablers
Data Collection <i>Defining & validating standards</i> 	<ul style="list-style-type: none"> Rapid growth in data availability Emergence of new “omics” technologies 	<ul style="list-style-type: none"> Variable measurement procedures Outcomes, context, metadata not captured Fragmented data standards 	<ul style="list-style-type: none"> Certified standards for measurements devices Broad adoption of foundational data standards
Aggregation and interoperability <i>Enabling integration and analysis across multiple datasets</i> 	<ul style="list-style-type: none"> Large investments in healthcare IT Proliferation of EHRs 	<ul style="list-style-type: none"> Datasets are often siloed Few integrated datasets across health systems 	<ul style="list-style-type: none"> Incentives for stakeholders Robust digital infrastructure to support sharing
Impact generation <i>Demonstrating proof of concept and making an economic case</i> 	<ul style="list-style-type: none"> Advanced algorithms in specific medical applications (e.g., radiology) Small proof-of-concept studies 	<ul style="list-style-type: none"> Additional evidence needed to support expanding precision medicine beyond genomics 	<ul style="list-style-type: none"> Small prospective trials Clinical decision support tools to disseminate new evidence

Human genetics: The next phase of biopharma R&D

- The goal of biopharma research and development (R&D) is to discover and develop innovative new drugs that improve the lives of patients.

- Clinical trial success rates can be improved by using large-scale human genetic analyses to validate biological targets and inform early termination or acceleration of clinical trial programs

- Target validation can enable biopharma R&D costs to be almost halved in certain therapeutic areas, with a corresponding transformative impact on biopharma R&D productivity.

- This innovative tool requires significant investments.

...the value of human genetics depends on the overall innovation strategy



Key success factors



Restructure the existing value chain by building scale in a key step



Rapidly scale by incorporating virtuous cycles and feedback mechanisms

Digital Transformation

Health in 2040 will be a world apart from what we have now.

Emerging Technology

- Radically Interoperable Data
- Artificial Intelligence (AI)
- Open & Secure Platforms

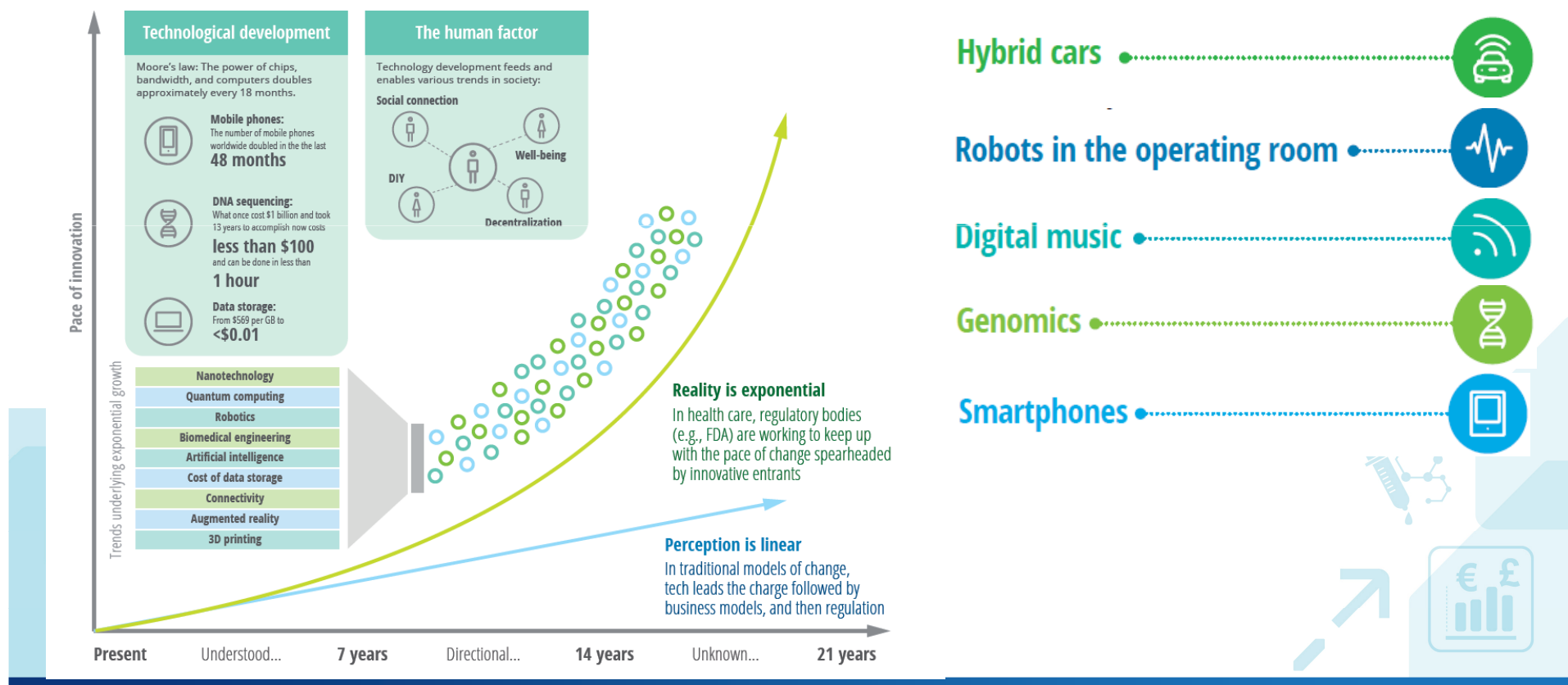
Health will be defined holistically as an overall state of well-being encompassing mental, social, emotional, physical, and spiritual health

Source: "Forces of change: The future of health", *The Deloitte Center for Health Solutions*

Exponential change and Innovation Cycles

Exponential change will accelerate the pace of disruption

Shifts in innovation tend to occur in seven-year cycles



Note: All dollar amounts are given in US dollars.
Source: "Forces of change: The future of health", *The Deloitte Center for Health Solutions*

Why does the future of health matter?



The cost of health care affects individuals, families and employers as well as local, state, and federal budgets.

In 2017, US health care spending topped US\$3.5 trillion (17.9 percent of the gross domestic product). That translates to US\$10,739 for every person in the country.



An estimated 133 million Americans have at least one chronic disease (such as heart disease, asthma, cancer, and diabetes), and the number of people who have a chronic illness has been rising steadily for years.

While chronic diseases are typically incurable, they can often be prevented or managed

Health care consumers typically interact with the health system only when they are sick or injured.



Prevention

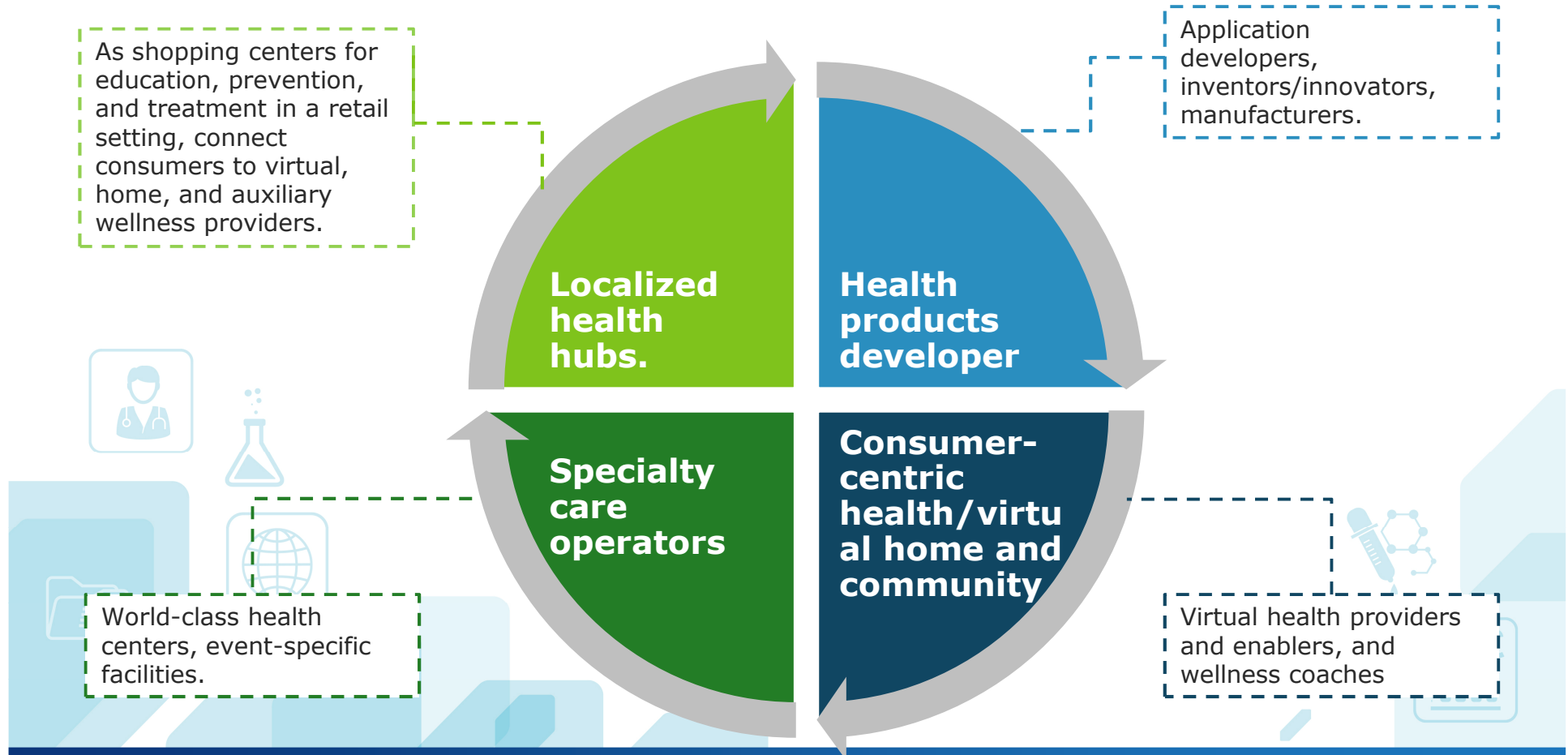
Health will be monitored continuously so that risks can be identified early

Source: "Forces of change: The future of health", The Deloitte Center for Health Solutions

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OF 

New Ways of Delivering Well-being Services and Care



Source: "Forces of change: The future of health", The Deloitte Center for Health Solutions

Archetypes as the Backbone for the Health Care Ecosystem

Data conveners

- **Data collectors, data connectors, and data securers:** The organizations that will have an economic model built around aggregating, storing, and securing individual, population, institutional, and environmental data. This data can be used to drive the future of health.

Science and insights engines

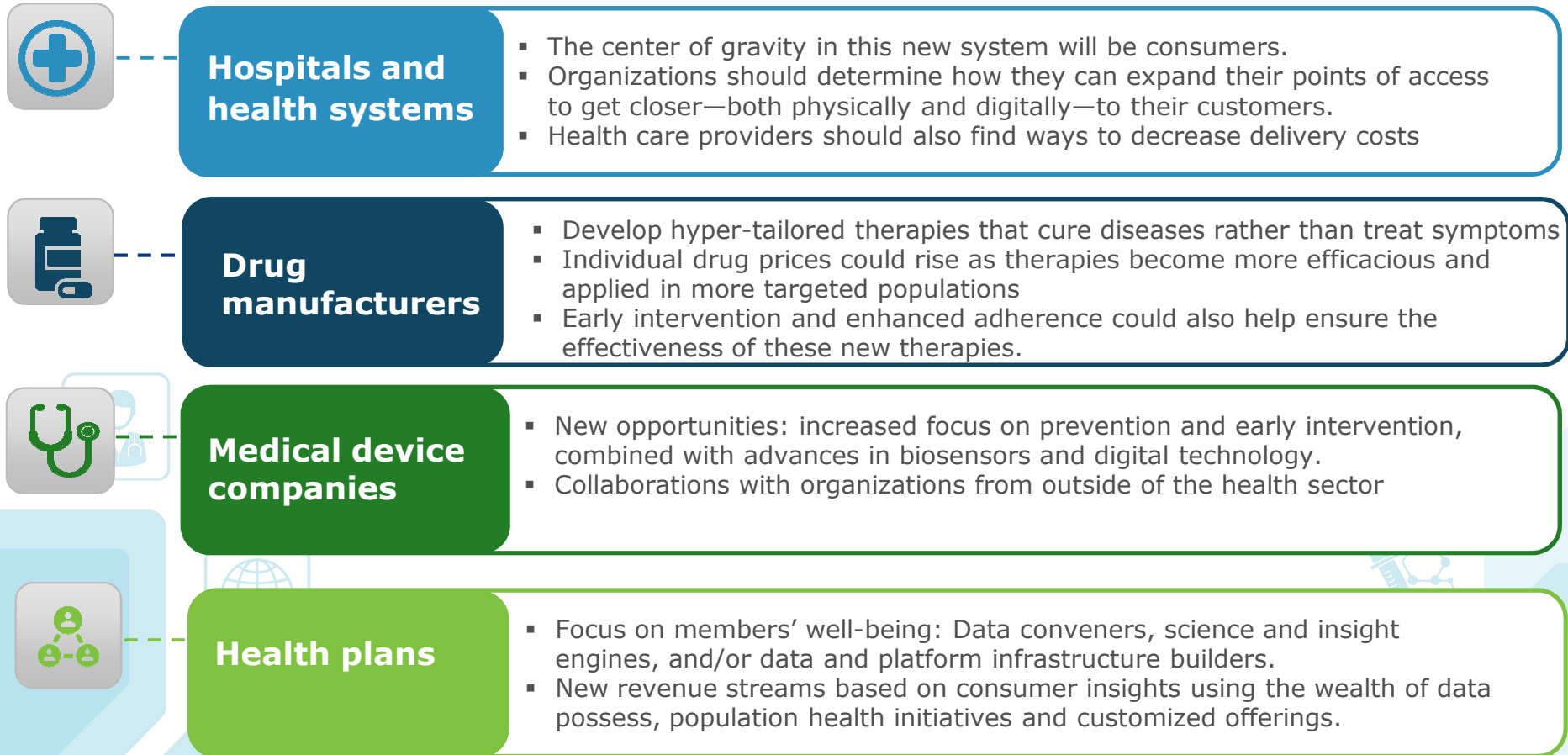
- **Developers, analytics gurus, insight discoverers:** Some organizations will likely have an economic model driven by their ability to derive insights and define the algorithms that power the future of health. These organizations can use machine-led activities to conduct research, develop analytical tools, and generate data insights that go far beyond human capabilities.

Data and platform infrastructure builders

- **Core platform developers, platform managers and operators:** This new world of health will need infrastructure and platforms that can serve highly empowered and engaged individuals in real time. (Someone will need to lay the pipes.) A limited number of large-scale technology players will develop core platforms, interfaces, and infrastructure to enable data sharing, virtual health, and consumer-centric health. They will also develop standards for platform and application integration, architecture, and user experience.

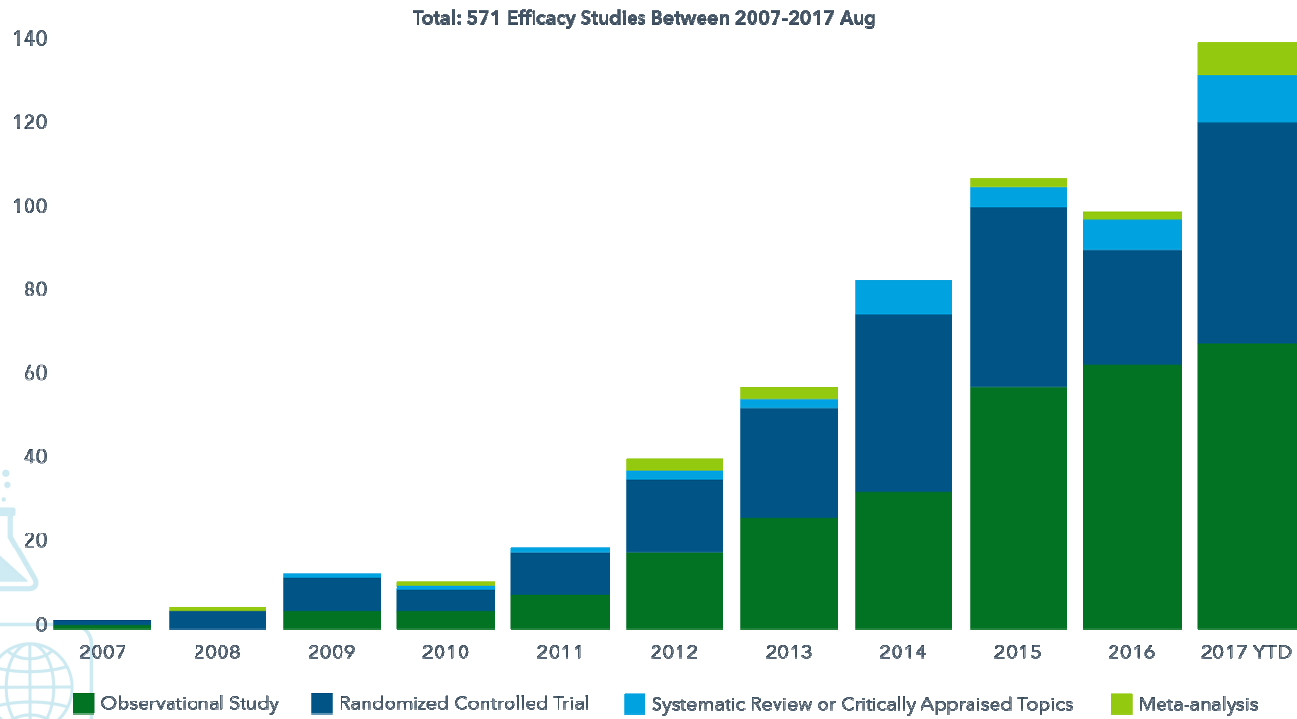
Source: "Forces of change: The future of health", *The Deloitte Center for Health Solutions*

New Business Models will Incorporate the Archetypes



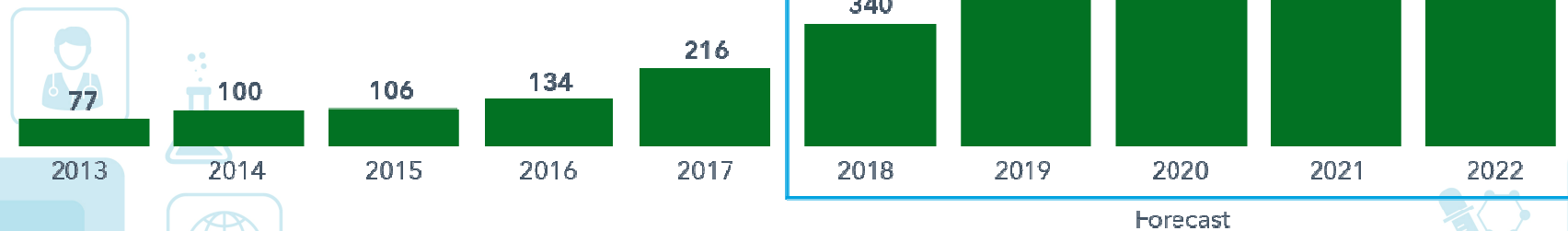
Source: "Forces of change: The future of health", The Deloitte Center for Health Solutions

Number of Published Digital Health Efficacy Studies over Time



Source: IQVIA Institute for Human Data Science. The Growing Value of Digital Health: Evidence and Impact on Human Health and the Healthcare System. Nov 2017
Report: 2018 and Beyond: Outlook and Turning Points. IQVIA Institute for Human Data Science, Mar 2018

Project Growth of Digital Health Published Evidence

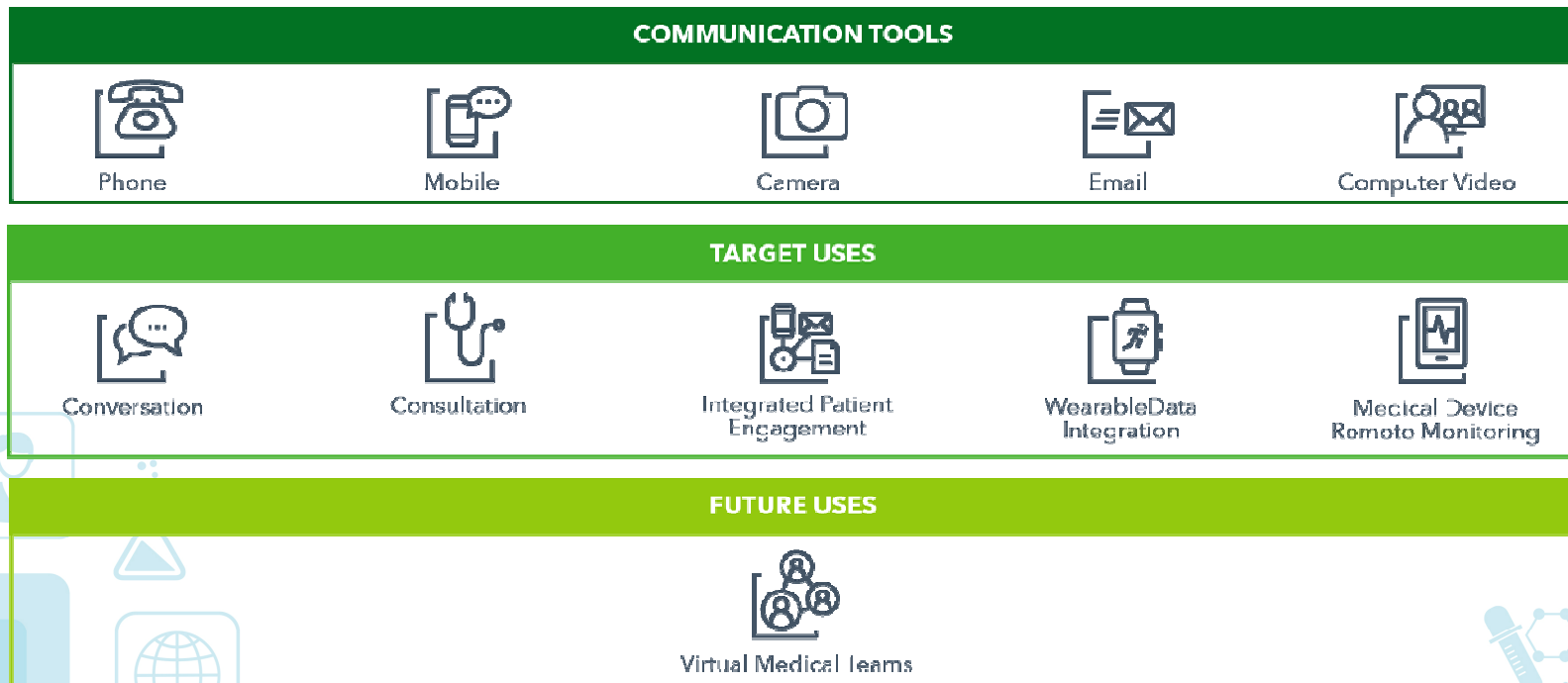


Source: IQVIA AppScript Clinical Evidence Database, Feb 18, 2018; IQVIA Institute, Feb 2018

Notes: 2018 data and growth in efficacy studies extrapolated from growth trend. Historical numbers updated since original publication based on database update.

Report: 2018 and Beyond: Outlook and Turning Points. IQVIA Institute for Human Data Science, Mar 2018

Telehealth Communication Methods and Uses

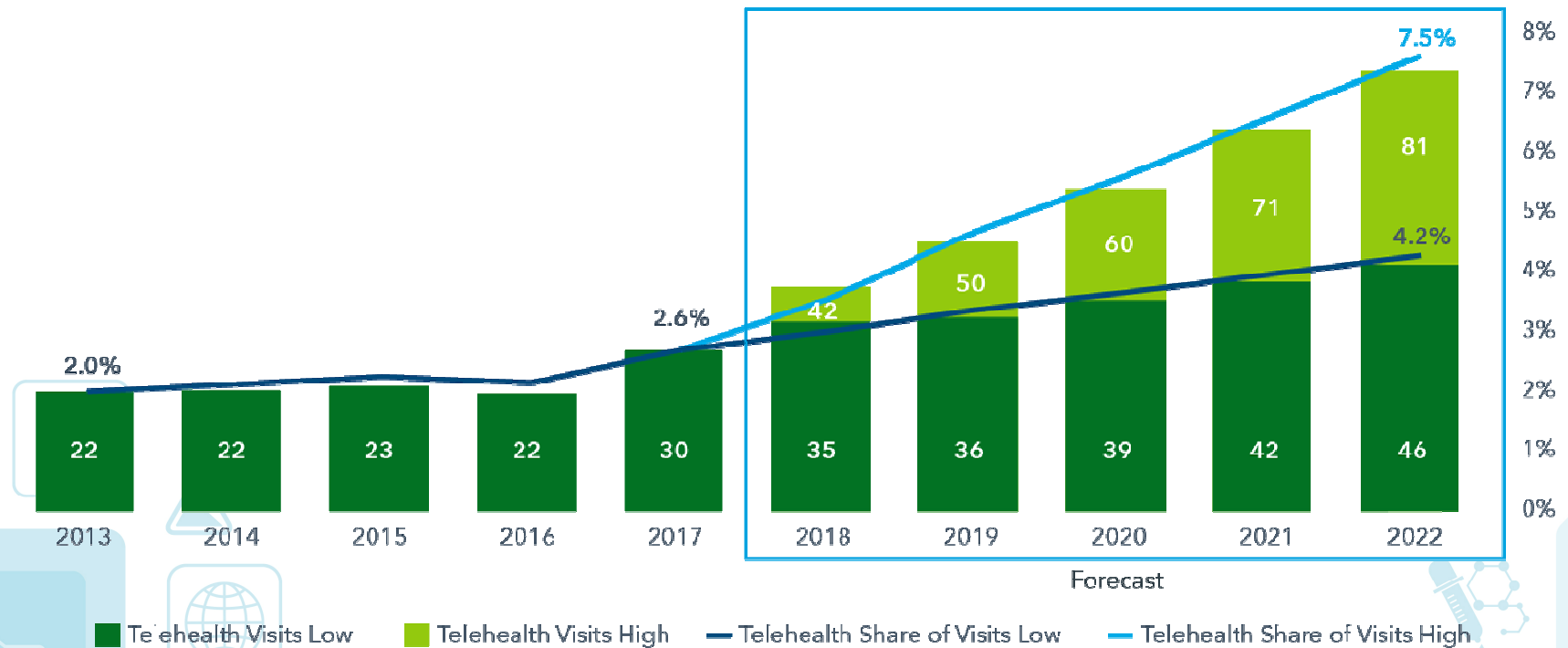


Source: IQVIA Institute, Oct. 2017

Report: 2018 and Beyond: Outlook and Turning Points. IQVIA Institute for Human Data Science, Mar 2018



U.S. Telehealth visits 2013–2022



Source: IQVIA National Disease and Therapeutic Index, Jan 2018; IQVIA Institute, Feb 2018

Reports 2018 and Beyond: Outlook and Turning Points. IQVIA Institute for Human Data Science, Mar 2018



The world around us and our customers is changing already



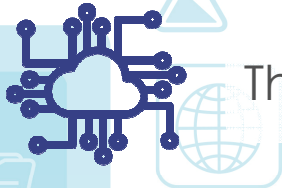
The world around us is changing. Look at your wrist



Our customers are changing: new preferences and much higher rate of data generation/utilization



Other industries have already been disrupted or changed utterly their business model to survive



The tools are already with us. **The Future is Here**

Our customers' life is complicated... and we contribute to the burden of it

Burden of Engagements

Lack of Time

New therapies



Multiple stakeholders



Continuous education



More expensive therapies



Repetitive & not always additive engagements



Congresses & Networking events



Continuous need to adapt, change



Private life



Our customers' life is complicated... and we contribute to the burden of it

Burden of Engagements

Lack of Time

new drugs approved last year in EU



Only **27%** of time dedicated to patients



7K+ articles published each month

\$ 100 K€+ cost of paradigm changing therapies



53% of MDs restrict access to reps



96% of HCPs would benefit from virtual participation



80% of HCPs think digital solutions will help them



80% of HCPs say job negatively affects their private life

“Doing things differently”



Digital
Solutions

“Engaging differently”



Digital
Marketing

Advanced
Analytics



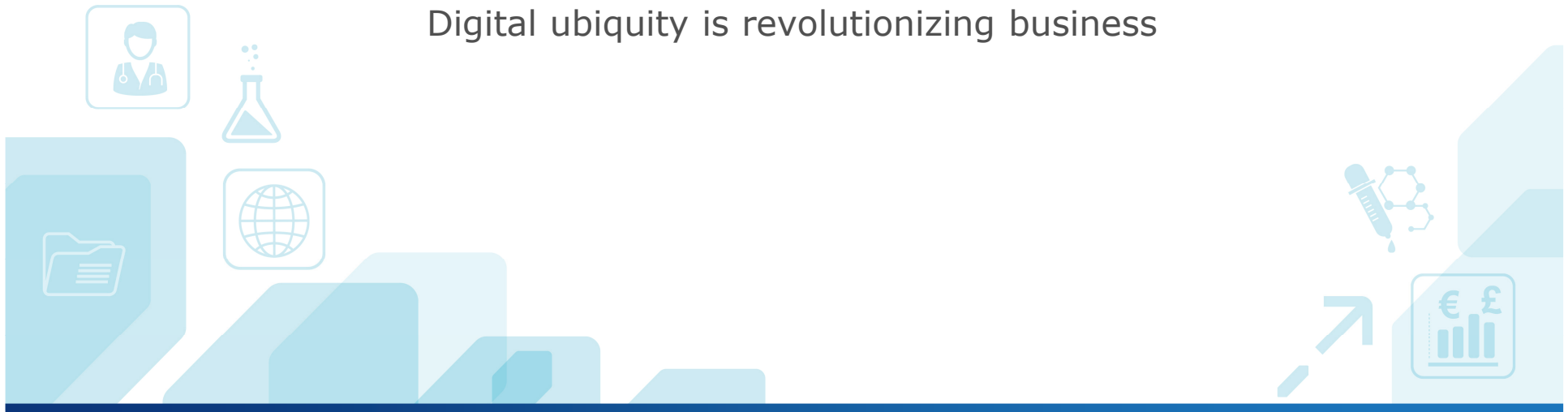
“Making the right decisions”

Automation



“Enabling processes”

Digital ubiquity is revolutionizing business



In summary...

Digital reconstruction is the new normal

Digital ubiquity is changing both business and operating models across most (all) industries

All major operating challenges are being digitized

- Customer interaction and relationship management
- Manufacturing and supply chain management
- Innovation and product development
- Human capital management

Digitizing operations is correlated with performance

The best companies are broadly digitizing operations to drive not only operational efficiencies but also innovation and new business opportunities

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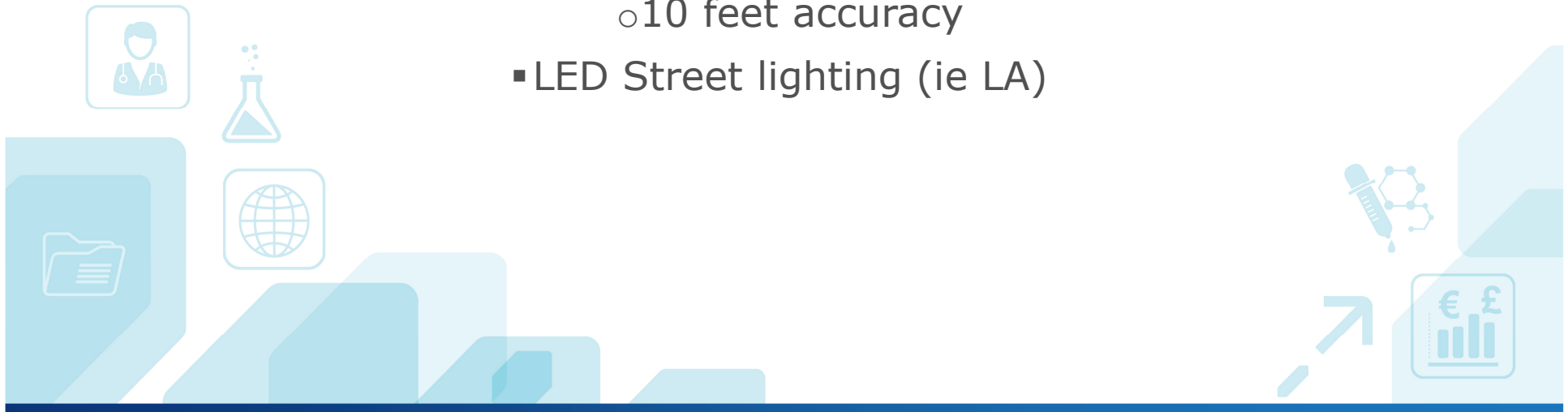
Tech Trends that will Change the World 2018 / 2019

Review of TECH Articles



“The future is already here – it is just not evenly distributed” (William Gibson)

- Hong Kong cashless society
 - Smartphones NFC and QR code
 - Next steps WeChat Pay and Alipay
- ShotSpotter in 90 cities (ie NY, Chicago, Cape Town etc)
 - Triangulate gunfire from a microphone network
 - 10 feet accuracy
 - LED Street lighting (ie LA)



“The future is already here – it is just not evenly distributed” (William Gibson)

- DNA kits

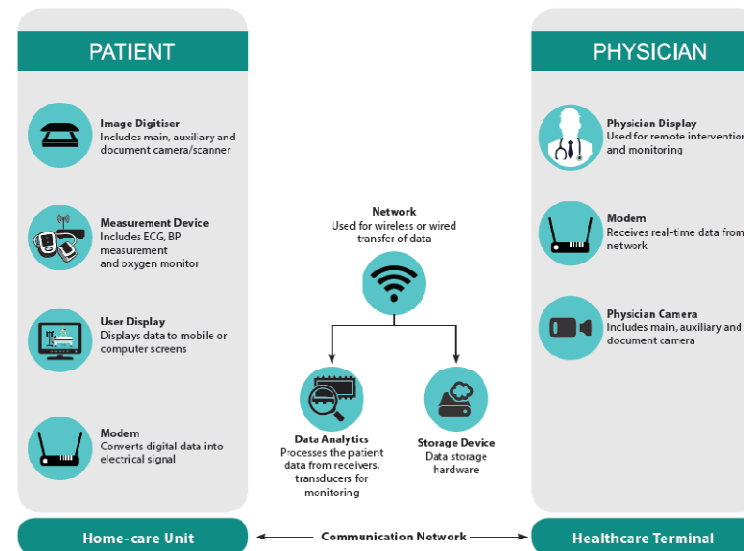
- Companies like: Ancestry DNA, Living DNA, 23andMe
 - DNA testing and personal genetics for
 - Deeper ancestry
 - Genetic Health risks
 - Carrier status for conditions
 - Price from 99-199\$

- Blockchain

- https://www.youtube.com/watch?v=SSo_EIwHSd4
- From BitCoin to Medical Records

“The future is already here – it is just not evenly distributed” (William Gibson)

- Internet of Health
 - **Internet of Health** is designed for clinicians, healthcare managers and technologists looking to exploit the IoT to upgrade efficiency and patient care.
 - [Internet of Health Conference Sep 2018, Amsterdam NL](#)





Leading in the Pharmaceutical Industry

Makis Papataxiarchis

Managing Director Janssen, Johnson and Johnson

Chairman AmCham Pharmaceutical Committee, President PhRMA

Thank you for your attention