~ **7.2 billion** phones worldwide

Google's made $75B in 2015

60% of U.S. adults say they track their weight, diet, or exercise routine

Mobile payments at **$620B**

92% of adult American adults own cell phone, **68%** are smartphones

Internet penetration = **46%** globally, 75% in developed countries, **25%** in developing countries

Every second –
2.5M emails sent; 55k searches on Google; **2,460,000** posts to FaceBook; 738 photos posted to IG

~2M apps in Apple & Android app stores
1M Amazon ECHOS shipped in 2015

Mobile healthcare market at **$10B** in 2016, estimated to be **$31B** by 2020

20M enrolled in US health exchanges

1/5 internet users have consulted online reviews and rankings of health care service providers and treatments

Factors for Digital Health

497M MDs participating in Medicare EHR Incentive Program payments

Sales of Tablets Surpassed PCs in 2015

88% of U.S. adults use the internet

72% of internet users say they looked online for health information within the past year

$5.9B predicted sales of digital fitness devices by 2019

Videos Viewed Per day –
Snapchat = 10B
Facebook = 8B

4B records breached since 2013

Factors For Digital Health

A White Paper By:

Lodestone Logic

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*To keep pace, biopharma players **must** revisit and fundamentally reassess many of the strategies, technologies, and operational approaches they currently use.*"[1]

Digital health is the new frontier of opportunity for life science and pharmaceutical companies. It is a far-reaching concept, and of course not every aspect of it affects every business unit or function. However, some aspects do -- and in profound ways.

The speed and impact of the progress made in technology over the past decade is being compared to the industrial revolution. This technological revolution includes the Internet of Things (IoT) comprised of solid and ambient sensors connecting and transmitting data between devices, on-demand and customized production with 3D printing, drones delivering medicine to rural regions, and advances in artificial intelligence (AI) through the application of big data analytics. Digital health opens opportunities to connect, engage, and collaborate with health care systems and technology entities that are actively adopting technology to improve care models and understanding disease.

Companies that look to the horizon and better understand what is happening will be able to create sustainable innovation and competitive advantage.

The world is more and more connected with each day –

75% of citizens in developed countries have access to high-speed internet[2]

7.2B phones are in use worldwide[3]

60% of US adults track their weight, diet, or exercise routine[4]

Empowered patients are already integrating technology to help them take more control over their health. Some have begun to use wearables and other technology to acquire and organize life and health habit data – steps, food intake, air quality, mood, menstrual cycle, and performance. It is predicted that the wearables market, including Apple and Samsung watches, exercise devices like FitBit, heart rate monitors from Garmin or Polar, and virtual reality goggles from Oculus Rift, PlayStation VR and the HTC Vive, will surpass **$34B by 2020.**
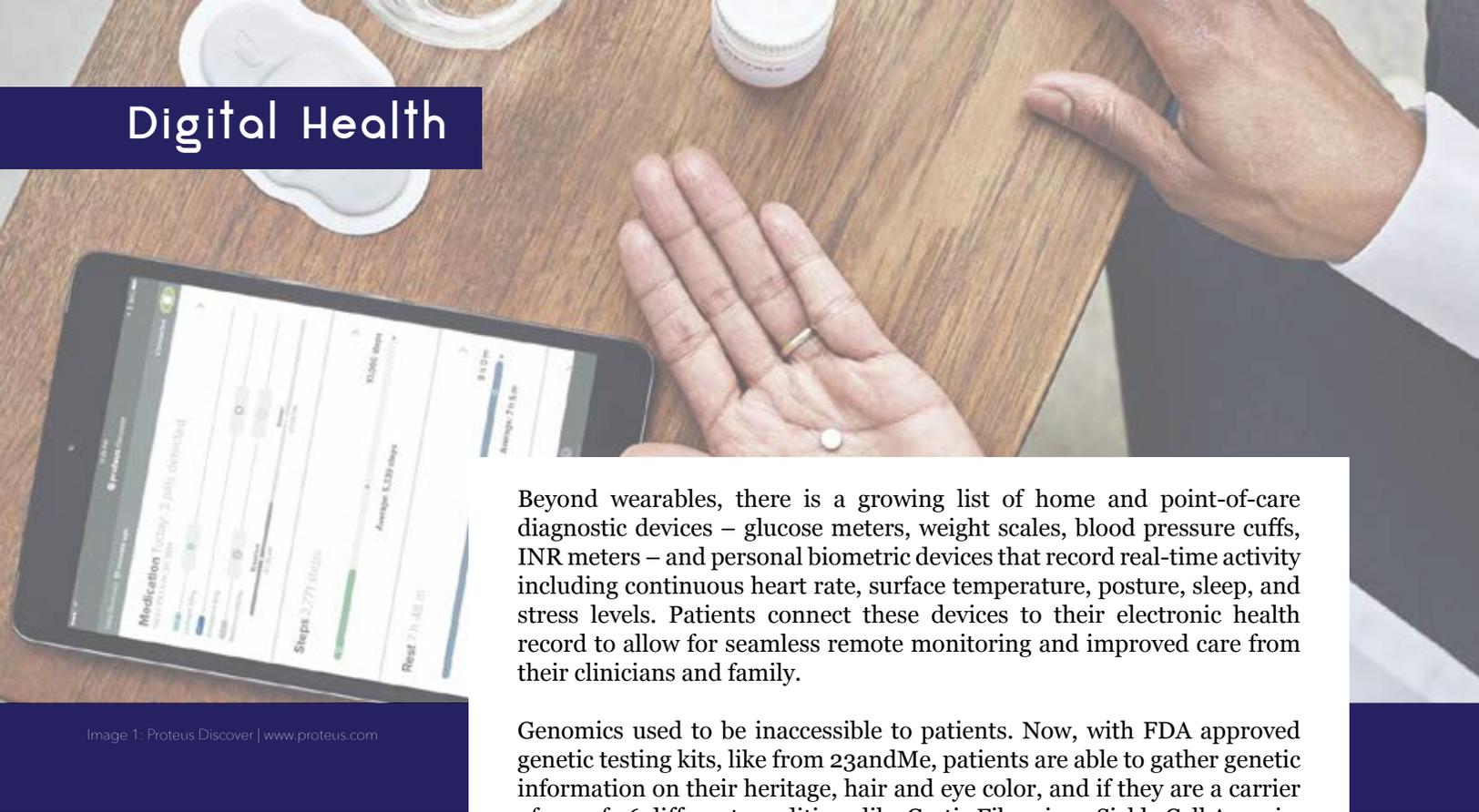
Image 1: Proteus Discover | www.proteus.com

Beyond wearables, there is a growing list of home and point-of-care diagnostic devices – glucose meters, weight scales, blood pressure cuffs, INR meters – and personal biometric devices that record real-time activity including continuous heart rate, surface temperature, posture, sleep, and stress levels. Patients connect these devices to their electronic health record to allow for seamless remote monitoring and improved care from their clinicians and family.

Genomics used to be inaccessible to patients. Now, with FDA approved genetic testing kits, like from 23andMe, patients are able to gather genetic information on their heritage, hair and eye color, and if they are a carrier of any of 36 different conditions like Cystic Fibrosis or Sickle Cell Anemia.

All this innovation and tracking of the quantified self, combined with the ease of use to the patient, is allowing people to have greater insights into their personal health history and for the patient and their health care provider to make more informed treatment decisions.

Patients can also share information about themselves with health care providers easily and more accurately than ever before. Proteus Digital Health has introduced Proteus Discover, which "is comprised of ingestible sensors, a small wearable sensor patch, an application on a mobile device and a provider portal… Once activated it unlocks never-before-seen insight into patient health patterns and medication treatment effectiveness…"

With nearly 500,00 members PatientsLikeMe is the world's largest personalized health network. Patients use it to connect and share experiences with others with the same disease or condition thereby generating real-world data.[5] On 5 January 2017 they announced that they entered into a partnership with iCarbonX "to apply next generation biological measures and machine learning, and accelerate a deeper understanding of the basis of human health and disease."

"The ecosystem we're creating will connect biology, experience and AI so that we can learn how diseases manifest in the body over time, and how our everyday actions contribute to their progression," said Wang. "PatientsLikeMe will be at the core of this ecosystem as we digitize, analyze and share insights and knowledge that can improve lives."[6]

AI is being explored in an attempt to widen access, cut healthcare costs and improve treatment by helping patients avoid unnecessary consultations and follow through on prescribed plan of treatment.

Chatbots like those from Your.MD are driving this process. "Imagine the AI is networked like a doctor's mind. A dense medical vocabulary library helps it pinpoint the patient's symptoms. Depending on variables like age,

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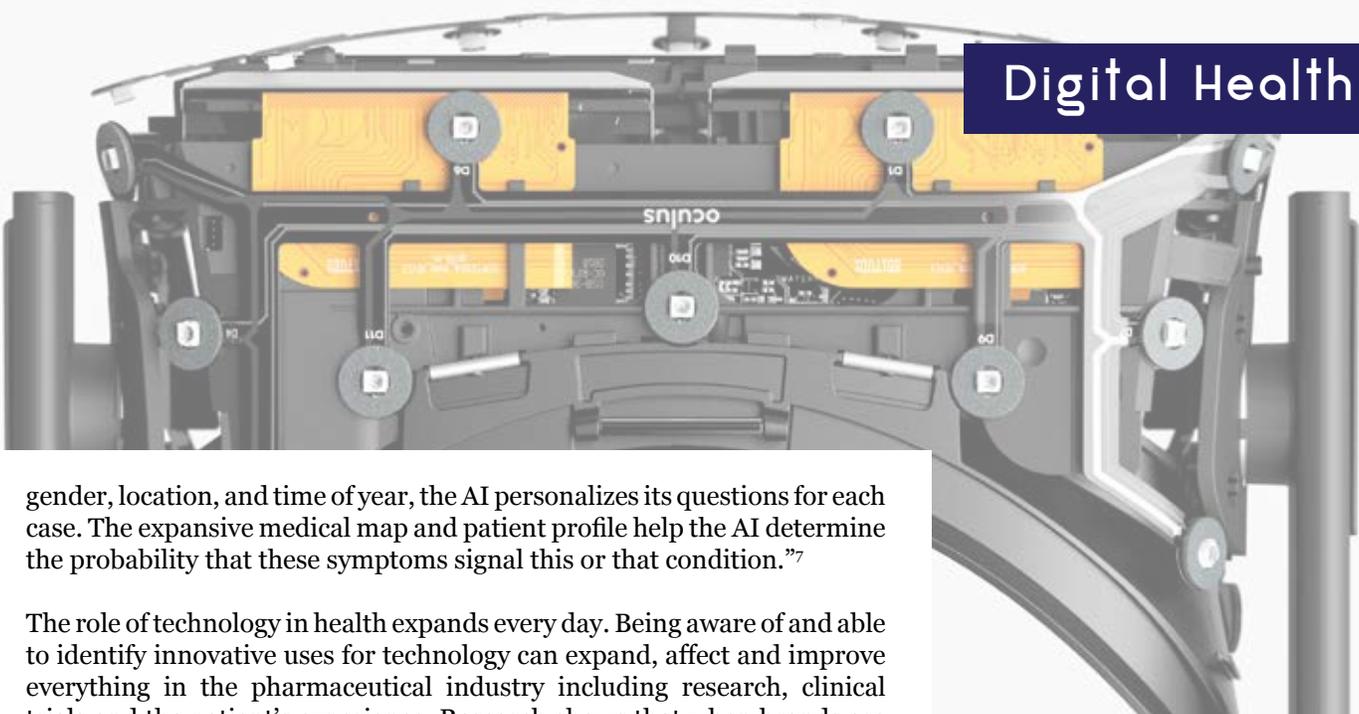
gender, location, and time of year, the AI personalizes its questions for each case. The expansive medical map and patient profile help the AI determine the probability that these symptoms signal this or that condition."[7]

The role of technology in health expands every day. Being aware of and able to identify innovative uses for technology can expand, affect and improve everything in the pharmaceutical industry including research, clinical trials and the patient's experience. Research shows that when brands are more accessible and transparent, consumers are more likely to become attached and possibly even advocate for them.[8] Patients/consumers want to engage with companies that help them - one-touch re-ordering of prescriptions, same day delivery, engaging directly with a company via mobile apps and chatbots. Patients will provide data if, in return, they receive better customer service and, ultimately, health outcomes.

The pharmaceutical product development lifecycle will be influenced by technology in every aspect of drug development. Pharmaceutical companies will use sensors and RFID to track a drug's time outside an environmentally controlled space, design custom 3D printed drugs in more locations minimizing 3rd party distributors, and utilize ongoing advances in Data Science to transform the way that clinical trials are conducted. In the future, real world and patient experience data are set to play a larger role in patient focused drug development.

One of the biggest challenges for organizations is to figure out ways to sufficiently survey the landscape of possibilities, then to spawn and exploit the innovative ideas and business models that will drive bottom line growth. The organisations that continue to be successful at being 'innovative' are the ones that are flexible enough to adapt to the increasing pace of change in the 21st century. These organizations are also the ones that are continuously connecting with and building relationships with a wide array of organisations to stimulate new awareness, insights, and knowledge.

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Lodestone Logic

Lodestone Logic is a global consultancy dedicated to helping companies seize the business opportunities promised by the digital health and big data revolution. We specialize in global perspectives on technology, policy, and the uses of healthcare data. We go beyond analysis to make innovation real, equipping your company with the kind of valuable industry connections, data and strategic insights, resourcing and actionable business plans you need to succeed. With our unparalleled understanding of the pharmaceutical industry, informatics, technology and healthcare sectors, we will work seamlessly with your team, offering project management, strategic planning, business and competitive intelligence, and project execution.

Lodestone Logic is a recognized global expert on health data flows — the innovative devices that are collecting and generating helped organizations design strategies and plans to take advantage of the entire digital health ecosystem including data flows generated by the patient via the Internet, social media channels, mobile phones, purchasing/transaction records, hospital electronic health records, eRX, billing and insurance company interactions.

As the trade groups, industry leaders, advocacy organizations and world governments convene to discuss the future of health data regulation and ethics, the Lodestone Logic team has been a critical facilitator and connector, planning summits and leading preparation for policy discussions and hearings (see Appendices for publication). Lodestone Logic has coordinated with organizations like the Pharmaceutical Research and Manufacturers of America (PhRMA), European Federation of Pharmaceutical Industries and Associations (EFPIA), International Medical Informatics Association (IMIA), the World Health Organization (WHO), American Medical Informatics Association (AMIA), and the European Commission (EC), as well as numerous healthcare providers, academic health sciences organizations, public health organizations, health insurers, patient and user representatives, and commercial businesses from the biopharmaceutical and technology industries.

Our research team at Lodestone Logic can provide you with the deep-dive industry assessments you need to make the right business decisions. Through the integration of our proprietary Lodestone Insights database with other data sources, Lodestone Logic is able to surface strategic regulatory, legal, technical, funding, and market forces affecting your business and industry.