DH briefs

Digital Health 101

The Basics You Need To Know

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About this report

This report provides a basic overview of digital health technologies and major players in the sector. All figures quoted in this report are linked to the original source.

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Introduction

Healthcare is one of the last industries waiting to be “properly” digitized. As such, it represents a **massive opportunity** for a number of players, including tech giants, start-tups, hospitals — as well as individuals involved in the industry.

This report is a shorter version of "Introduction to Digital Health".

This report is a much shorter version of “Introduction to Digital Health,” made to convince people they need to invest in their “digital health education” — which in turn will help people **enter this fast-growing sector** and help all of us get better healthcare. Cause sooner or later, we’ll all be needing it, and at that point – we better have the best tools and technology money could buy (without spending a small fortune, that is).

In the report, we’ll be going through major challenges the healthcare industry faces, explore the opportunities for digitization, cover key technologies as well as major players looking to disrupt the *status quo*. Most notably, we’ll see what the Big Tech is doing in this space — hint: they are investing billions.

Read on and get ready for the brave new world of digital health…

What is Digital Health?

In this section, we'll be explaining the digital health basics – what it is, why it matters and who is looking to benefit from it.

We will also be talking about basic terms to prepare you for the pages (sections) ahead…

Defining Digital Health

Digital health presumes using technology to help improve individuals' health and wellness. It is a broad sector whose goal is to **digitize healthcare and bring it to the 21st century**.

Both major tech companies and startups are pitching in to solve the "healthcare conundrum."

What's wrong with the healthcare sector, you may ask?

Sure, the costs are rising like it's nobody's business, but that's just one piece of the puzzle. Ask yourself:

- Do you have access to your health records? How can you get them?
- What about x-ray and other medical images? Can you access them?
- How do you schedule a doctor's appointment?
- Does your doctor know how physically active you are?
- How about your insurance – does it appreciate your long runs in the morning?
- Can you see a doctor on your phone?

These are just some of the questions people are asking these days. After all, they get to see their banking and credit card accounts whenever they want but they can't do the same with their OWN health records. Something's wrong here and the problem is bigger than you think. That is why it takes so much time to turn things around.

Luckily both major tech companies and the growing number of startups are pitching in to solve the "healthcare conundrum." It is a marathon, not a sprint and you better be prepared.

That's what this report is all about, to help you prepare for the **new era of digitized healthcare**.

What is mHealth?

mHealth — also written as m-health or mhealth — is an abbreviation for mobile health, which is a term used for the practice of medicine and public health supported by mobile devices. The term, coined by Robert Istepanian, is most commonly used in reference to using mobile communication devices, such as smartphones, tablets and PDAs, as well as wearable devices such as smartwatches, for health services, information, and data collection. The mHealth field has emerged as a sub-segment of digital health, which presumes the use of IT for health services and information.

8 factors driving the digital health revolution

After defining what's digital health all about, let us turn our attention to factors driving the sector. We have identified 8 specific factors:

1. Aging population

Simply put, there are not enough beds to put baby boomers in hospitals once they start to get sick (which typically comes with age). Digital health solutions, such as remote monitoring and telehealth, could help seniors age at home, while enabling doctors to stay in touch with them at all times and at a fraction of the cost.

2. Healthcare is getting more expensive

In the U.S. – it accounts for 18% of the country's GDP. To put this figure in perspective, the U.S. healthcare is as big as GDP of France. Again, digital health technologies could reduce costs across the board, and this is especially true with chronic conditions, treating which accounts for a lion's share of any country's health spending.

3. More bandwidth

In most places, people still get x-ray images on a CD if not on a film. While it is useful to have those images available at home/office, it would be even better to store them — along with other medical images — in the cloud and have them accessible by all interested parties, including doctors, family members and so on. Today's internet is fast enough to enable this. Also the storage has never been so affordable and abundant.

4. Increased security

One problem with health records is that you can't just let everyone carry them around — they could be stolen or compromised in some other way. Pretty much all newer phones come with a fingerprint reader that could be used as a gateway to provide users and authorized third-parties with access to health records of any individual. A system could be developed to unlock health records on one's phone or tablet for a predetermined period (say 15 minutes) after which all data is erased.

5. Mobile revolution

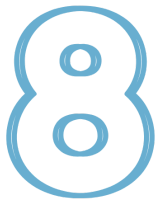
People are already using smartphones which serve as an entry point for many of emerging digital health solutions; they (could) provide users with quick access to their health data. Smartphones are also used to connect to other health devices, such as smart scales, activity trackers, blood pressure monitors, glucometers, and more.

6. Doctor shortage

According to the Association of American Medical Colleges, the United States will suffer a shortage of up to 104,900 doctors by 2030, and the situation is similar in other parts of the world, as well. Telehealth services could help address this gap while at the same time keeping costs at bay.

7. The lack of healthcare infrastructure in developing countries

A number of countries in Asia, Africa and Latin America have an even worse problem, as they lack the basic healthcare infrastructure. In these places various digital health solutions could be used to bridge the gap and provide access to health services to people living in rural areas, with smartphones and few smart, portable instruments being used for diagnosis.



8. Genomics revolution

It used to cost hundreds of thousands of dollars to have the human DNA sequenced; today it is possible to get a full genomic sequence for a few thousand dollars. Also, there are some consumer-facing companies offering simple genetic records for a few hundred dollars, while some even offering personalized nutrition and fitness plans based on one's DNA. This market is just starting out…

Combined, these factors have inspired a number of companies, both big and small, to seize the opportunity.

Who wants a piece of the digital health pie?

Many different organizations are interested to take part in the digital health revolution, including:

1. **IT giants** such as Google, Apple, Microsoft and Amazon are already on board, offering a number of apps, services and platforms. Apple has a trio of platforms and a smartwatch; Google has a dedicated company exploring novel health technologies (Verily); Microsoft also has a platform of its own(Microsoft HealthVault); while Amazon has an online pharmacy, a wearable device and its own tech-enabled health clinic.

Among those looking for opportunities in the digital health space are IT giants, startups, VCs, pharmaceuticals, health IT vendors, hospitals, universities and research institutions.

2. **Big pharma** is also on board, with many of the biggest companies launching apps and games to improve adherence, promote their drug use and even conduct trials — most notably, using Apple's ResearchKit platform. Also, some of them are testing so-called "digital pharmaceuticals."

3. **Traditional health IT companies** like Epic, McKesson, Philips, Allscripts and others — which provide solutions for health records, population health and care coordination — are looking to add mobile technology to their respective offerings, while also making their systems sing along those of competing vendors to achieve interoperability.

4. **Hospitals and health systems** are looking to embrace digital health solutions both to increase productivity and cut costs, as they transition from fee-for-service to value-based reimbursements.

5. **Universities and research institutions** are on board to help the industry, commercialize their own technologies and test some of the new systems.

6. **Startups** are also trying to innovate in the field, bringing along new ways of thinking to the market. Silicon Valley is not the only one competing for the "digital health dollars" — there are also big startup communities in the New York City area, Los Angeles, Chicago and other major cities. Moreover, we have foreign companies making headways in the space, as well.

7. Finally, **Venture Capital firms** are keen to keep up with what startups are doing. In addition to "regular" VCs, we have a few corporate VCs that are very active in the digital health space — most notably investment divisions of Google, GE and Qualcomm.

The ecosystem is emerging and in the next section, we'll take a look at what the big tech is doing in this space…

Tech Giants in Digital Health

Tech giants already play an important role in our lives but with their tremendous resources, they also want to be ever-present in the fast-growing digital health market.

In the following pages, we'll talk about what Google, Apple, Amazon and Microsoft are doing to help us live longer and healthier lives.

Google

Across its various divisions and initiatives, Google has invested billions in digital health. It operates a few platforms, a separate company dedicated to digital health technology, while its venture arm(s) have made quite a few investments throughout the industry. Let's start by looking into Google's health-related platforms:

Google's platforms

There are a few platforms we need to mention here:

Google Fit

Google Fit is the company's equivalent to Apple HealthKit, serving as a central point to all of the user's health and fitness data. The platform is made to sync with other apps and connected devices, providing users with a single point of view of all their, mainly fitness data. Virtually all fitness apps and connected devices sync with Google Fit.

wearOS

Google's smartwatch platform and an operating system is used by a few vendors but it failed to reach the popularity the Apple Watch has in the iPhone community. Simply put, wearOS still looks like a work in progress, the fact that has pushed Samsung and Huawei — two major Android vendors — to develop their own smartwatch platforms. Nevertheless, Google isn't giving up on its smartwatch ambitions and has even acquired Fitbit (and alongside its FitbitOS) in 2019.

Google Health Studies

In December 2020, the Google Health Studies app and service was announced to make it easier for leading research institutions to connect with potential study participants — Android smartphone users. The first study is focused on respiratory illness, inviting users to take part in health studies by answering survey questions and contributing relevant data. The app makes it easy for participants to understand their contributions to each study, as well as access research findings when they become available.

Google Glass

Google's augmented reality (AR) glasses and the AR platform are these days mostly used by enterprise customers, those in the healthcare being among them. In fact, Google Glass has been used for quite a few times in the operating room, allowing surgeons to stream procedures in real-time to enable some students to learn from remote locations. The Glass has spurred an entire ecosystem of apps that don't require hands

to operate, while providing surgeon with useful information and even guidance in the operating room.

Google search & healthcare

Google's core business and the main cash cow remains its search product that is used by billions every day. Users across the world are asking "Dr. Google" health-related questions and the company did a remarkable job to serve them proper answers and links to relevant websites. To that end, Google is working alongside major healthcare institutions to deliver accurate search results.

In addition to end-users (patients), Google also aims to provide a better search experience for providers and researchers. For instance, it has developed a time-saving tool for clinicians navigating complex EHR interfaces and workflows. Ascension, one of the largest health systems in the US, will be the first to pilot this new tool.

Google Cloud & AI

Google is also looking at powering the healthcare data infrastructure layer through its Google Cloud offering. It is not only providing the healthcare ecosystem with various hosting-based services but also AI-related products and services while helping them build data sets for their own systems and algorithms.

Google is using AI to tackle various diseases – from monitoring to detection, to lifestyle management. The company's use of (AI) technology includes data generation, which presumes collection and digitization of data produced by wearables, imaging, and MRIs among other methods.

Verily

Formerly known as Google Life Sciences, Verily is Alphabet's digital health / life sciences division, operating as a separate company that is forging "deep collaborations" across the entire healthcare ecosystem — from academic research institutions to life sciences companies to hospitals and health systems. Verily has strong partnerships with some of the largest pharmaceutical companies such as Johnson & Johnson, Sanofi, Novartis and so on. It is focused on using data to improve healthcare via analytics tools, interventions, research, and more.

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And that's not all. The search giant has also formed a few notable partnerships with healthcare industry leaders and had invested a ton in the space through its venture capital division. More on that in our full report "Introduction to Digital Health".

Apple

Apple started its healthcare efforts with a simple idea – to sell more of its high-margin hardware. But as that was the case with its music and app offerings, the company's healthcare-based venture(s) also seem poised to turn into a big business by itself.

It was the Apple Watch that helped the Redmond-based giant forge partnerships with companies and institutions from across the healthcare industry.

Apple Watch

Originally released in April 2015, the Apple Watch is by far the most popular device in its category despite the fact it is only working with iPhones. That popularity alongside solid developer tools has helped the company attract quite a few developers to make apps for its wearable.

The device includes support for pretty much all popular sports and fitness activities – including running, cycling, walking, yoga, pilates, and swimming – to name a few. Aside from regular users who rely on it to track their calories, the Apple Watch is also being used by the medical community for remote monitoring, alerts, clinical trials and more.

Apple's platforms

The iPhone maker operates three digital health platforms:

ResearchKit

ResearchKit is an open-source framework that allows researchers and developers to create apps for medical research. Its feature set enables developers to easily create visual consent flows, real-time dynamic active tasks, and surveys using a variety of customizable modules… Among those using ResearchKit are such well-known institutions as the American Heart Association, COPD Foundation, Harvard Medical School, Stanford Medicine, UCSF, University of Oxford, Yale School of Medicine, Johns Hopkins, Duke University, Boston Children's Hospital, Massachusetts General Hospital, and others.

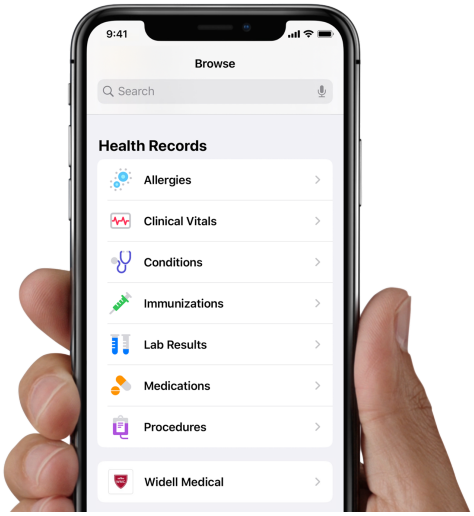
CareKit

CareKit is an open-source software framework enabling developers to build apps that help users manage their medical conditions. As such, it makes it easier for hospitals to engage with patients before and after they leave the hospital – providing a central platform for caregivers and physicians to monitor a patient. CareKit can also become a platform third-party services can plug into (e.g. non-emergency medical transportation).

HealthKit

Apple HealthKit is a developer framework that provides developers and manufacturers with a set of tools to make their apps and devices compatible with Apple's Health app. The framework can securely share users' health data between compatible apps and services. For example, if you use a smart device with its own app to monitor your weight each day and a second app to track the number of calories you consume daily, HealthKit would let the scale app share weight data with your calorie-monitoring app to give you more insight.

Apple's Personal health records



Accessing Apple Health Records from an app

This is the area Apple has been looking at since 2013 but made inroads with the acquisition of Gliimpse in 2016. The company's solution was unveiled in March 2018, relying on the FHIR standard (FHIR stands for Fast Healthcare Interoperability Resources) to pull in data from hospitals. Initially, the service was launched with support from 39 hospitals, including such big names as Adventist Health System, Mount Sinai, Cleveland Clinic, Intermountain Healthcare, Stanford Medicine, Scripps, Partners, Ochsner Health, Vanderbilt and Duke University. Apple has ever since updated its offering with new partners to allow users to get lab data directly into the Health app; and in October 2020, the Health Records feature was launched in the UK and Canada.

Fitness+

In September 2020, Apple announced Fitness+ alongside the Watch Series 6, touting it as the first fitness experience built for Apple Watch. The service incorporates metrics from Apple Watch for users to visualize right on their iPhone, iPad, or Apple TV – offering what the Cupertino-based company calls a "first-of-its-kind personalized workout experience." Everyone from beginners to committed exercisers can access studio-style workouts delivered by world-class trainers and underscored by motivating music from renowned artists.

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In just a few years, Apple has managed to establish itself as an important player in the digital health space with organizations from across the (healthcare) industry partnering with the iPhone maker over clinical trials, technology and more. Down the road, we can envision Apple working on its own ecosystem on top of its health records offering, adding telehealth and coaching services to the mix.

Amazon

As a leading cloud service provider, Amazon has been present in the healthcare industry for quite some time but its offering extends beyond Amazon Web Services (AWS). Nevertheless, AWS is still the giant's cash cow with other services still not making a dent in its profits.

That being said, let's go through Amazon's healthcare offering:

AWS

Through AWS, Amazon is collaborating with customers across the healthcare continuum – including providers, public health organizations, government agencies, and life science businesses around the globe to support their IT infrastructure efforts. Among the AWS' major customers are illumina, HealthCare.gov, Celgene, Cleveland Clinic, CDC, DNAnexus, Bristol-Myers Squibb, and Allergan.

Amazon Alexa

Voice could become an interface to facilitate interaction between patients and physicians, and in that sense – Amazon's virtual assistant Alexa enables new patient touchpoints for partners via Skills. Some of these Skills enable users to access physician reviewed-information regarding conditions, drugs, side effects, etc; find an urgent care location near them and schedule a same-day appointment; query their last blood sugar reading, blood sugar measurement trends, receive personalized insights; and more; verbally report medical data; get exercise and adherence reminders; call a caregiver; and coordinate transport. Alexa virtual assistant could be accessed from Amazon's line of Echo smart speakers as well as other devices that have "Alexa built-in."

Amazon Care Hub & Alexa Together

In September 2020, Amazon announced **Care Hub**, a way for people to monitor the activity of older adults or people who wish to live independent lives but may need assistance from friends or family. The service works through Alexa-enabled devices like Echo speakers, including the ability to ensure that if a device hears "Alexa, call for help" that it can automatically call an emergency contact. Echo devices do not allow people to call 911, but Care Hub means that as long as far-field voice recognition picks up a voice, it can call a designated contact.

Announced a year later, **Alexa Together** builds on top of Care Hub, allowing multiple family members or caregivers to assist and remotely monitor aging family members in their homes. For in-

stance, it enables caregivers to set reminders, manage shopping lists, and set up music services without having to access an Alexa device in person. The subscription also includes a 24/7 urgent response service, and is compatible with third-party fall detection devices. Alexa Together is offered for $19.99 per month or $199 per year after free trial.

Amazon Pharmacy

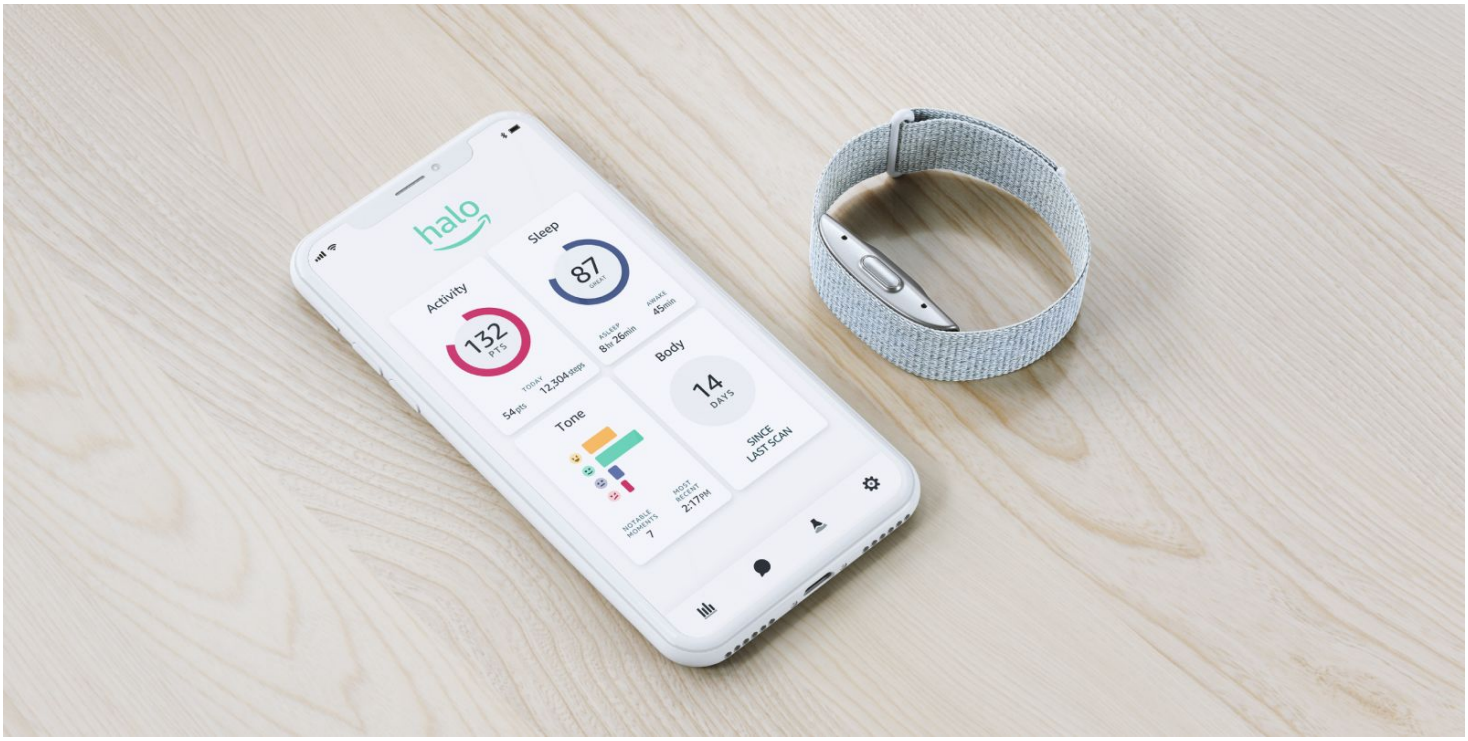
In November 2020, Amazon Pharmacy has been officially launched to offer home delivery for prescription medication in 45 states, excluding Hawaii, Illinois, Kentucky, Louisiana and Minnesota – which will be added in the future. The service lets customers create their "secure pharmacy profile" that could include information about their health insurance, outstanding medical issues like allergies, and any regular prescriptions. It offers a range of both generic and brand-name drugs, including commonly prescribed drugs like insulin, triamcinolone steroid creams, and so on – but not Schedule II medications such as many common opioids like Oxycontin.

Amazon Care

Amazon Care was launched in September 2019 as a virtual and in-person healthcare offering for the company's employees, initially those with the company's health insurance plan located in and around the Seattle area. The service is accessible through an app, offering chat and remote video, follow-up visits and prescription drug delivery in person directly at an employee's home or office. In March 2021, the company announced that it will offer Amazon Care to everyone (not just its employees) in the U.S. And in August 2022, it was announced that Amazon Care would shut down by the end of the year. It is expected that the tech giant refocuses its primary care efforts around One Medical, which it acquired in July 2022.

Amazon Halo

At the end of August 2020, Amazon launched the Halo Band wearable and an accompanying service to engage the wider audience in healthcare. The device has no screen of its own but its companion app comes with two novel capabilities – it uses the smartphone's camera to create 3D scans for body fat and the built-in microphones can listen for the emotion in the user's voice. Additionally, the Halo Band also tracks all the usual data points, like activity, calories and sleep. In September 2021, Amazon Halo View with its own display and several other enhancements was announced. And in September 2022, the Halo Rise joined the lineup – a contactless sleep tracker designed to sit on a bedside table from where it can detect sleep quality and states, coupled with movements and breathing patterns.



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Amazon's ambitions in the healthcare space are vast and the company is seemingly just getting started. Down the road, we could envision the retail giant becoming a benefits marketplace for employers and payers by offering a frictionless method to access benefits. Also, it could potentially turn its Amazon Care offering into a back-end infrastructure service for provider groups.

In addition, Amazon will also be targeting end-users with offerings such as the Halo Band and PillPack…

Microsoft

Most hospitals are operating on Windows machines, making the Redmond giant present in virtually all healthcare facilities. Adding to this is the fact that many of these facilities have switched their emails to Microsoft 365 and you get a compelling picture of just how big and omnipresent the Redmond giant is in the healthcare space.

Due to the widespread use of Windows PCs, Microsoft is present in virtually all healthcare facilities.

In addition to Windows that is running the show on most hospital PCs, Microsoft's offering for healthcare facilities includes:

Microsoft 365

Formerly known as Office 365, Microsoft 365 is a line of subscription services that includes Microsoft's popular software from the Office suite like Word, Excel and PowerPoint alongside – in some variations – Microsoft's cloud-based services such as SharePoint, Exchange, and OneDrive. It also includes several artificial intelligence features that, according to Microsoft, make users more productive.

Also included in the offering is Microsoft Teams, a communication and collaboration platform that combines workplace chat, video meetings, file storage, and application integration. The service, which competes with business messaging apps like Slack, can also be integrated with non-Microsoft products.

Azure

Microsoft's cloud offering competes with similar services offered by the market leader Amazon (AWS) and Google. The Redmond giant launched the Microsoft Cloud for Healthcare in May 2020 as an industry-specific cloud solution for healthcare providers. As such, it brings together a set of capabilities that already exist inside of Microsoft, such as Microsoft 365, Dynamics, Power Platform, Teams and Azure, including Azure IoT for monitoring patients.

HoloLens

Microsoft HoloLens is a pair of mixed reality smart glasses. It was the first head-mounted display running the Windows Mixed Reality platform under the Windows 10.

HoloLens houses many sensors as well as cameras and projection lenses to do its magic. Also included are 3D audio speakers which can be used to simulate spatial ef-

fects, allowing the user to perceive and locate a sound, as though it is coming from a virtual pinpoint or location.

In the healthcare space, HoloLens is being used for:

- Holographic surgical planning
- As an in-surgery heads-up AI bot
- Onside/remote surgery assist
- Immersive healthcare training
- Contextual patient data visualization
- Immersive cognitive therapy

Also, during the COVID-19 pandemic, the headset was being used to reduce the amount of staff coming into contact with COVID-19 patients.

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In our full report, we also look at what Facebook, Samsung and Big Pharma are doing in the digital health space.

Technologies

In this section, we'll go through different digital health technologies.

Specifically, we'll be talking about remote monitoring, telehealth, new on-demand care services, digital assistants, medication management solutions, sensors, blockchain, virtual reality and more.

Electronic health records

Arguably the most essential health IT tool, an electronic health record (EHR) is the systematized collection of patient and population electronically-stored health information in a digital format. These records can be shared across different health care settings.

EHRs may include a range of data, including demographics, medical history, medication and allergies, immunization status, laboratory test results, radiology images, vital fsigns, personal statistics like age and weight, and billing information. As such, EHRs help clinicians identify and stratify chronically ill patients. Also, EHRs can improve the quality of care by using data and analytics to prevent hospitalizations among high-risk patients.

Aside from providing a complete picture of any single patient's health, EHRs enable researchers to conduct population-level studies. That's where so-called Population Health solutions come, enabling doctors to — for instance — better manage epidemics.

Remote Monitoring

Remote monitoring involves utilizing special devices such as blood pressure monitors, glucose meters, heart rate monitors and wearable activity trackers that can be used by patients at a remote location.

Remote monitoring involves utilizing special devices that can be used by patients at a remote location.

Up until recently, remote health monitoring required expensive equipment and dedicated connections that were provided by such giants as Philips and GE. Today, with the increasing use of smartphones, these devices are more affordable relying on phones' built-in connectivity to send collected data to caretakers and family members. These devices are typically used to provide better chronic care management while keeping the cost down, as well as to enable healthcare providers to continue care management once the patient leaves the hospital.

In addition, smartphone-connected devices could also help seniors live more independently in their own homes.

Various research organizations are forecasting that the global remote patient monitoring devices will reach almost $2 billion by 2025. The major factors driving this growth include technological developments like innovative portable monitoring devices, rising incidences of unhealthy lifestyle-related disorders and the enhancing healthcare infrastructure.

Wearables

Wearable devices, or wearables for short, are already helping users take better care of their health by nudging them to exercise and sleep more and lead an overall healthier life.

According to multiple research organizations, worldwide shipments of wearable devices in the first quarter of 2018 surpassed 25 million units, with wrist-worn activity trackers and smartwatches accounting for 95 percent of the number.

Fitbit Alta HR, Xiaomi Mi Band 3, Garmin vívomove HR, Misfit Shine 2, Polar A360

And that apparently is just a start with other forecasts suggesting that the entire market will become worth over **$70 billion by 2025**.

It is, however, important to distinguish between a few wearable device categories:

- **Activity trackers** – which can track one's activity, sleep and in some cases heart rate; they can also send notifications to one's wrist.
- **Hybrid watches** – which look like regular watches and are also able to perform the same tasks as activity trackers.
- **Smartwatches** – that are powered by an operating system so they could run third-party apps.
- **Hearables** – also known as smart headphones, these advanced, electronic in-ear-devices double as activity trackers. Also, modern hearing aids can connect to smartphones.
- **Smart clothing** – new technologies have made it possible to weave electronics into a shirt, a blanket, a shoe, or pants to perform specific patient care functions, including help with a growing aging population.

Aside from letting users take better care of their health, all device types could be incorporated as part of the remote health monitoring plans.

Apple Watch, Huawei Watch 2 Classic, Samsung Gear S3 Frontier, Fitbit Versa

Smart watches could be especially useful in areas such as medication management and fall detection. These devices could "talk" to other connected devices around the home and be used to operate lights, locks, thermostats and other appliances, allowing users to perform everyday tasks with simple hand gestures.

Digital Assistants

Voice activation technology gained traction on the heels of Amazon's launch of Echo smart speaker, which was later expanded to include an entire series of devices. This technology has made simple tasks like searching Google for the best restaurant, taking notes, asking about weather and more, as easy as asking the same question to a friend.

The attention these products got prompted other tech giants to join the game, and ever since we have seen Google (Google Home series) and Apple (HomePod) releasing their own smart speakers, with Microsoft working to bring its Cortana voice assistant to a device near you. Samsung also wants a piece of this market and so do a few Chinese companies that are preparing to launch similar offerings in the world's most populous country.

In addition to helping users get answers quickly, these devices could also help alleviate the loneliness and isolation of the elderly. Also, they hold a huge potential to get people to be more active at home, encouraging users to maintain healthy habits.

Amazon Echo series, Google Home series, and Apple HomePod

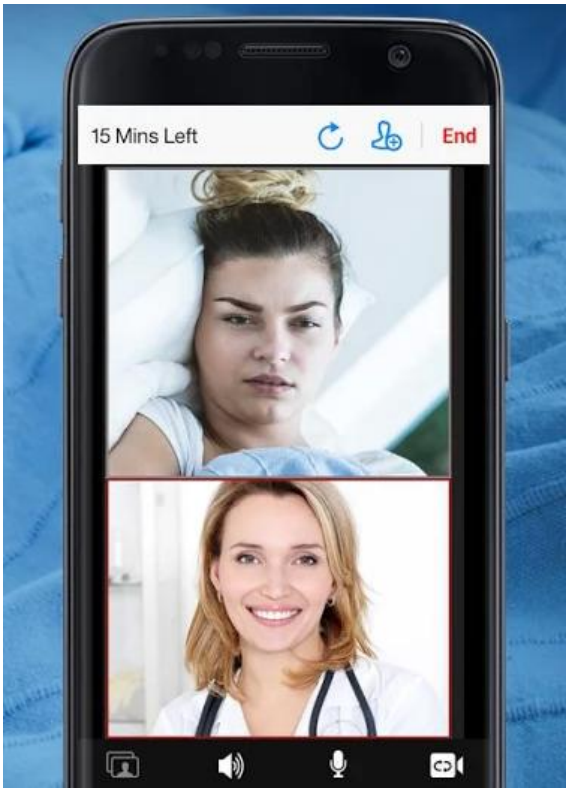
For those who suffer from dementia, digital assistants can be a reassuring source of knowledge that never feels annoyed or frustrated, no matter how often a question is repeated. Also, they can be used to set verbal reminders.

On the other hand, for people with vision problems, voice activation technology can read news and weather updates, as well as books, text messages and emails. Furthermore, these devices can even help craft a written response through voice commands, play a song, shop for stuff online, and more.

For all users, they provide a helping hand during emergencies, enabling them to quickly summon a nurse and the loved ones.

Telehealth

The World Health Organization defines telehealth as a practice that involves the use of telecommunications and virtual technology to deliver health care outside of traditional healthcare facilities.



A telehealth mobile app (Amwell)

Telehealth examples include **virtual home health care**, where patients such as the chronically ill or the elderly may receive guidance in certain procedures while remaining at home. Telehealth has also made it easier for health care workers in **remote field settings** to obtain guidance from professionals elsewhere in diagnosis, care and referral of patients. Training can sometimes also be delivered via telehealth schemes or with related technologies that make use of smartphones, tablets or computers and the internet.

Well-designed telehealth schemes can improve health care access and outcomes, particularly for chronic disease treatment and for vulnerable groups. Not only do they reduce demands on crowded facilities, but they also create **cost savings** and make the health sector more resilient. In addition, the use of telehealth technologies is also helping bring healthcare services to rural areas and to people lacking viable transportation options.

Telehealth versus Telemedicine

Telehealth is sometimes discussed interchangeably with telemedicine. The Health Resources and Services Administration (HRSA) distinguishes telehealth from telemedicine in its scope. According to HRSA, telemedicine only describes remote clinical services such as diagnosis and monitoring; while telehealth includes preventative, promotive and curative care delivery. This includes the above-mentioned non-clinical applications like administration and provider education which make telehealth the preferred modern terminology.

Digital Therapeutics

Digital therapeutics (DTx) are software products that deliver evidence-based therapeutic interventions to patients. They are made to prevent, manage, or treat a broad

spectrum of physical, mental, and behavioral conditions. Digital therapeutics are distinct from pure-play adherence, diagnostic, and telehealth products.

According to the Digital Therapeutics Alliance, these are the core principles all DTx solutions must adhere to:

- Prevent, manage, or treat a medical disorder or disease
- Produce a medical intervention that is driven by software, and delivered via software or complementary hardware, medical device, service, or medication
- Incorporate design, manufacture, and quality best practices
- Engage end users in product development and usability processes
- Incorporate patient privacy and security protections
- Apply product deployment, management, and maintenance best practices
- Publish trial results inclusive of clinically-meaningful outcomes in peer-reviewed journals
- Be reviewed and cleared or approved by regulatory bodies as required to support product claims of risk, efficacy, and intended use
- Make claims appropriate to clinical validation and regulatory status
- Collect, analyze, and apply real-world evidence and product performance data

As such, digital therapeutics hold a great promise for all parties included in the healthcare eco-system.

On-demand Care

Up until around 30 years ago, the majority of a doctor's practice was made by performing in-person house calls and visits to their patients. Then, cities started expanding along with the number of equipment doctors needed to perform tests, and those in-

person house calls were replaced by efficient hospitals, doctor's offices and modern insurance plans.

Today, we have not one but a few startups trying to bring the doctor, or a nurse, back to the patient's doorstep. These companies think it is time to "Uber-ize" the healthcare space with a new kind of on-demand services. Also, the idea behind these services is that many users will value the convenience and comfort of receiving treatment and exams in their own homes.

On-demand, in-person visits are said to be a great supplement to primary care, and are best used for things like annual physical exams; blood tests; colds, ear infections, headaches, etc; specialist recommendations; flu shots; medicine prescriptions; family health assessments; and so on.

How does an on-demand doctor house call work?

The process is straightforward:

- A patient schedules a house call through the app or website, providing their address alongside other details such as insurance information, and description of symptoms.
- A doctor, nurse or other healthcare worker shows up to — based on the symptoms and diagnosis — perform physical assessments and vital sign tests. If needed, he/she could also prescribe medications or lab work.
- Patients pay what they're due, which is typically somewhere between $50-$200, or — if that's an option — use their insurance to cover (part of) the cost.
- After the visit, some services will send users a digital summary of the services provided.

Medical Imaging

Medical imaging software solutions are used for aiding diagnosis, comparing images between patients or within the same patient at different time points to assess the progress of the disease, and evaluating prognosis. They can also be integrated with patient data in other records, such as electronic health records (EHR), health information systems, and radiology information systems (RIS).

The market for medical imaging software has been growing in recent years, propelled by increased demand for advanced imaging equipment, rapidly growing big data in healthcare, and growing healthcare IT & EHR adoption. In addition, integration of imaging systems with electronic health records, penetration of AI in medical imaging, rapidly growing telehealth market, and rising adoption of hybrid cloud-based solutions offer significant growth opportunities for players operating in the medical image management market.

There are three areas in the medical imaging market:

- Medical image archiving and recording
- Medical image sharing
- Use of artificial intelligence (AI) in medical image analysis

The last mentioned is especially interesting due to the shortage of trained radiologists in many parts of the world, leaving room for novel technologies to be developed to accelerate the diagnostic process and eventually provide targeted effective treatments.

Genomics

Modern genomics is very much connected to the digital health space with emerging technologies helping researchers make sense of the different data from our genomes. And with the falling price of genome sequencing, new startups emerged promising to deliver new insights and novel treatments.

But the (genomics) space isn't unified; there are many companies in this space offering different kinds of solutions for an array of health-related issues. Lets take a look at several of the most important product categories in this market:

Personal genomics & ancestry
Companies in the direct-to-consumer (DTC) genetic testing space allow anyone to order a test from home — and, consequently, learn about their risks for medical conditions and/or about their ancestors. The testing process involves the company sending users a kit to collect his/her saliva. After they get the sample back, the saliva is examined and the report made available for download to the user.

Pharmacogenomics
Defined as the study of variability in drug response due to the genetic code, pharmacogenetics argues that despite general sentiments, medications do not have the same effect on people. This, apparently, is the reason why some people who drink coffee after 6 pm cannot sleep, whereas others might have a double espresso at 11 pm and sleep around midnight as if nothing happened. Pharmacogenomics is viewed as a highly important area for improving drug therapy and prescriptions in the future.

Precision oncology
National Institutes of Health (NIH) defines precision oncology as "an emerging approach for disease treatment and prevention that takes into account individual variability in genes, environment and lifestyle for each person." This approach allows doctors and researchers to predict more accurately which treatment and prevention strategies for a particular disease will work in which groups of people. As such, precision medicine is our best hope against cancer.

CRISPR
Working like genetic scissors, CRISPR is the most efficient and most accurate method to edit a cell's genome. However, while it opens up a myriad of opportunities, it is also raising frightening ethical challenges in healthcare. Nevertheless, the US National

Institutes of Health (NIH) gave CRISPR the green light for testing as it could emerge as the ultimate weapon against cancer, malaria and genetic disorders.

Extended Reality

Extended reality (XR) is one of the key technologies shaping up the future of healthcare. The utilization of XR in the industry is already showing signs that it can diminish costs, increase access, and improve outcomes for individuals around the globe.

Most notably, XR will drive a realignment of the current convictions about where healthcare happens, who gives the care, and who profits from it. As healthcare reaches out of the hospital and the doctor's office and into individuals' homes, the outskirts of businesses will be broken down as entertainment, wellness, med-tech, social media, and hardware organizations all vying for a piece of the healthcare pie.

Extended Reality is an umbrella term that encompasses all real and virtual environments which include virtual reality (VR), augmented reality (AR) and mixed reality (MR).

VR gives healthcare professionals around the world access to authentic surgical simulations at low cost.

There are quite a few use cases for extended reality technologies in healthcare, including:

1. Patient education
2. Surgical training

3. Mental health
4. Pain management
5. Stroke recovery
6. Telehealth
7. Fitness
8. Concussion assessment
9. Visual aid

We have just scratched the surface on Extended Reality technology here. For more details, we suggest you check our "XR in Healthcare" report that goes into much more details.

Blockchain

Blockchain is one of those buzz words you can hardly miss in the media these days. It was propelled to the public imagination with the rise of Bitcoin, Ethereum and other cryptocurrencies, but the technology can have many other uses cases beyond moving money from one side of the planet to the other.

In fact, it is now in minds of many tech giants and even governments which can clearly see blockchain's power to **transform how businesses operate** by decentralizing business models, creating more efficient processes, and providing a more secure and reliable way to exchange data.

The healthcare industry is one of the sectors where blockchain can really prove its worth. For one thing, it can **reduce the liability and accuracy concerns** related to the exchange of medical data, while providing cryptographic security to protect patient identity "out of the box." Eventually, every patient will have its own "data wallet" to

store and manage his/her medical records, and provide third parties with access to that data when needed.

Beyond **health records**, the technology could also be used to automate many administrative tasks in healthcare, thus removing human errors in areas such as payment processing and claim adjudication, which in turn could lead to improved accuracy and reduced costs.

Another use case for blockchain is in **supply chain management**, where a decentralized network could help medical suppliers and pharmaceutical companies better track how their products are moving from the production facilities around the world to a local pharmacy and to the patient.

And that's just a start with new use cases popping up on a regular basis.

Conclusion

Digital health is here to stay. In fact, it was one of the very few industries that thrived during the COVID-19 pandemic — and we still don't see the signs of it slowing down.

Digital health was one of the very few industries that thrived during the COVID-19 pandemic.

We've covered what we think are the most important technologies that are having a big impact on healthcare while also highlighting some health-related ventures of the Big Tech.

Together, both established players and new entrants could make a dent in this space, ultimately helping us leave longer and healthier lives.

By now, you have probably realized there is real money to be made in digital health and it is our hope that you will find a niche where you could fit into. Whether you're looking to start your own company, join a startup or an established company – you should now have enough information to get ahead.

And that's why we've created DHbriefs in the first place – to provide you with relevant information that could help your career or your company thrive.

If you still haven't, make sure to subscribe to our full-blown program and get our full report "Introduction to Digital Health" as well as all other reports we offer.

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