future society

Healthcare Innovation
Health Tech

***Healthtech*, or health technology, is a broad concept that refers to how technologies can be applied in the field of health and medicine.** Technology has been used intensively in medicine for many decades and even centuries: the first microscope dates back to the end of the 16th century, X-rays were discovered in 1895, and with them diagnostic imaging. Later developments such as implants, dialysis machines or robotic surgery are examples of what this subject can contain.

Technology is part of medicine and of the growing battery of means to improve health, to prevent diseases and to predict their onset. **New technologies such as artificial intelligence, *big data*, virtual reality, nanotechnology**, personal health applications, or personal monitoring devices, such as activity bracelets or wearables, **are revolutionizing the quantity and quality of medical information and the activity of mankind, allowing better diagnoses and better prevention of diseases and ailments.**

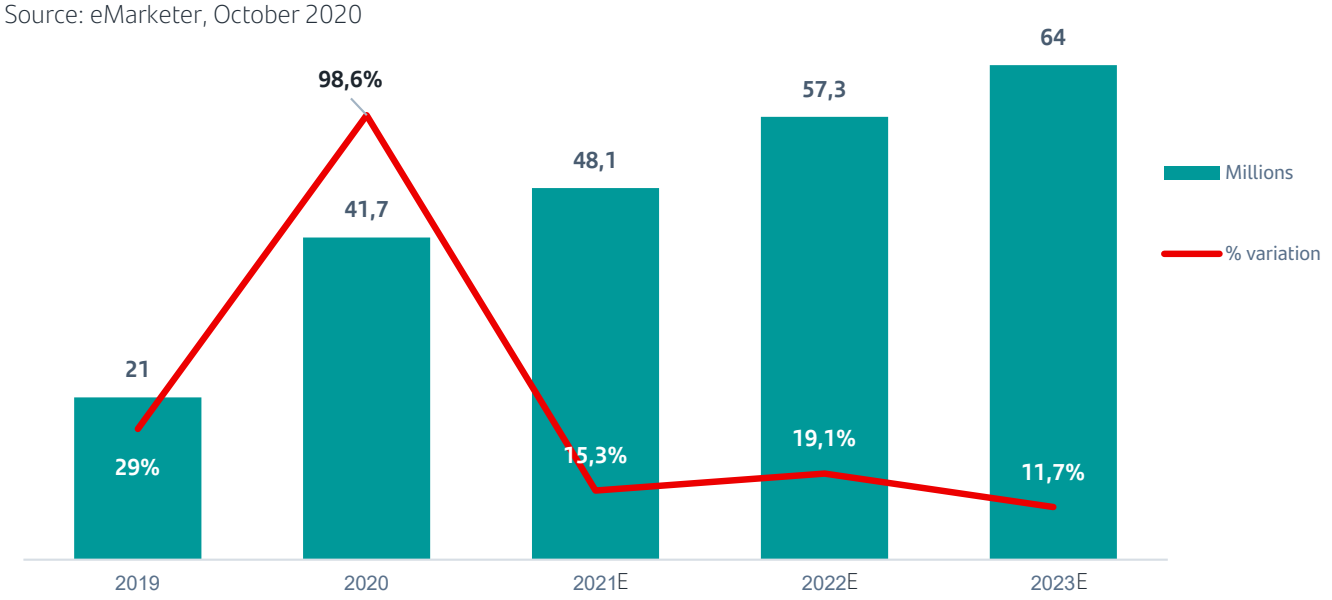
The Covid-19 pandemic was a catalyst for innovation in long-distance healthcare, as can be seen in the graph. Just as it was necessary to transform face-to-face work into telework overnight, so too was there **a radical breakthrough in medical care through telemedicine** as a preventive measure to limit the spread of the virus while maintaining health care. The **benefits in terms of time are significant**. Not only is travel avoided, but waiting times for consultations are reduced or eliminated, and even the fact of being able to have regular consultations can enable doctors to detect problems early.

Advances in the internet and the proliferation of *smart devices* have been fundamental because they allow telemedicine applications to connect to health applications so that physicians **can monitor online patient data** such as **heart rate, oxygenation or blood glucose level**. Some smartwatches can do **electrocardiograms**, are capable of making automatic emergency calls if programmed to do so. A step further is the **integration and exchange of a patient's data** between medical organizations, avoiding the repetition of diagnostic tests and **thus allowing a more global view of the state of health**.

The most well-known side of technology applied to medicine and medical treatments are the systems and devices used in hospitals for diagnosis or surgery. An October 2019 Time magazine article ***"12 Innovations That Will Change Health Care and Medicine in the 2020s"*** mentions for example the generation of *big data* through all *wearables*, which is starting to become important and is going to allow a better understanding of different medical conditions and how to have a better approach when innovating. **Medical and pharmaceutical research could combine records of millions of patients** and relate them to their various treatments, activity environment, lifestyle habits. Another example, **artificial intelligence can discover pathologies and disease patterns** appropriately combined with *big data*, in addition to its ability to "read" all the scientific information published on a given disease; while *blockchain* can help preserve the privacy of records and their anonymous transmission in global networks.

U.S. telemedicine users

Source: eMarketer, October 2020



Key innovations driving growth in health technology

Telemedicine

Telemedicine uses communication technology to provide medical care to patients without the need to be in the same physical location, such as videochat through applications or webcams, telephones or videoconferencing software. Prior to the pandemic, these services were generally limited ad hoc services with a variety of restrictions. Originally "remote" care was implemented to help rural and underserved patients access specialists when local help was very limited. It is now considered a cost-effective first line of treatment for non-urgent and follow-up consultations. **Patient demand has been the major driver of growth**[1] **.** This demand for convenient access to care will continue and, as a consequence, will create higher expectations on providers. Finally, telemedicine will not be possible without the technological infrastructure to support it, so further investment is needed. The use of **digital health tools** is constantly evolving, from COVID-19 tracking applications, to **wellness trackers, to telehealth and virtual health applications,** all accessible from the comfort of home.

Internet of Bodies (IoB)

***Internet of Bodies* or IoB refers to a network of devices that can collect data about the human body and/or alter its functions**. IoB devices **are physically connected to or inside the body, allowing them to monitor and possibly interact with it**.

There are three types of devices[2] : 1) First generation/ **External body**: These devices **are worn or physically attached to the human body**. They collect and transmit data based on physical contact through sensors, computer vision. Examples of these are *wearables* such as *smart watches* or fitness bands, smart contact lenses and glucose sensors. 2) Second Generation/ **Internal Body**: These devices **are placed internally in the human body**. They can be ingested or surgically implanted. In this field we find cardiac devices and digital pills, which are ingested and transmit data from inside the body. 3) Third Generation/ ***Body Embedded***: This is a stage in which **electronic devices can be completely fused with the human body** and work together maintaining a remote connection in real time. We are talking about microchips that are implanted in the body to, for example, release recurrent doses of medicines. Like any digital device that can be remotely connected, they would be exposed to cybersecurity risks.

Automation cognitive

Cognitive automation is a subset of artificial intelligence or AI and is capable of performing tasks that only humans were capable of performing in the near past, such as medical diagnoses. The enormous potential for the healthcare sector centers on the possibility of improving early diagnoses from information being acquired from other patients.

Time is very critical in diagnosis, especially of serious diseases. Delay in diagnosis puts the patient at greater risk of worsening or succumbing to the disease. With these advances, healthcare personnel could have a contrast tool that would facilitate diagnosis as **the automated process provides quicker and more accurate results**. With a more accurate diagnosis, there is a lower risk of complications from patients receiving the wrong treatment. Physicians are confident in their recommendations and patients receive the most appropriate treatment. **It is easier and less expensive to treat diseases before they cause serious damage to the patient's body**.

1. https://www.mckinsey.com/industries/healthcare-systems-and-services/our-insights/how-covid-19-has-changed-the-way-us-consumers-think-about-healthcare
2. https://www.analyticssteps.com/blogs/internet-bodies-everything-you-need-know

Examples of innovators in Life Sciences

Teladoc Health, Inc. offers a unique end-to-end **virtual healthcare** solution capable of serving organizations and individuals worldwide. Their services **cover the full spectrum of medical needs** from simple to complex, seamlessly integrating general medicine, mental health and **specialty care to deliver convenience**, results and value. They are operational 24 hours a day, every day of the year.

Dexcom, Inc. DexCom is a medical device company that develops and markets **continuous glucose monitoring, or CGM**, **systems for diabetes management by patients, caregivers and physicians worldwide**. DexCom works with partners **to develop combined glucose monitoring and insulin delivery systems**. These partners include Eli Lilly, Insulet, Novo Nordisk, Tandem Diabetes and The Ypsomed Group.

Siemens Healthineers AG operates as a medical technology company. It **extends precision medicine with maximum personalization of diagnosis, therapy selection, aftercare and health management**. This helps them to understand the patient as completely as possible. They are looking to **leverage their extensive expertise in imaging and robotics to expand their relevance in cardiovascular and neurovascular care**. The company is looking to leverage its **leadership in oncology** by broadening the diagnostic and therapeutic pathway for the disease. According to the company they have an annual R&D budget of €1.5 billion.

Inspire Medical Systems **develops implantable neurostimulation systems to treat obstructive sleep apnea.** Its revolutionary technology is the **first and only obstructive sleep apnea device** approved by the U.S. Food and Drug Administration (FDA) **that treats the root cause of sleep apnea by working inside the body with the patient's natural breathing process**. The company was formed in 2007 from a spin-off of Medtronic.

Shockwave Medical, Inc. **manufactures intravascular devices and balloon dilation catheters for patients with calcified cardiovascular disease**. Its technology is based on the same principles for the treatment of kidney stones (urologic lithotripsy) adapted for calcium in the cardiovascular system (intravascular lithotripsy). The urological method uses shock waves to disintegrate kidney stones. **The intracoronary method allows, through a balloon, to administer ultrasound pulses that fracture the calcium in the plaque with** a high level of safety and effectiveness.

Catalent, Inc. provides technologies to **improve delivery and development solutions for pharmaceuticals, biologics and consumer health products.** The company's oral, injectable and respiratory delivery technologies address the diversity of the pharmaceutical industry. They offer **end-to-end solutions from development and bio-manufacturing to fill/finish and packaging for new biological entities, cell and gene therapies, biosimilars, sterile injectables and antibody-drug conjugates.**

Did you know?

154%

That's how much **telehealth utilization increased** in March 2020 compared to the same period in 2019(1)

397 billion

This is what the **global telemedicine market** is estimated to be worth in 2027, a **compound annual growth rate of 25.8% over the period 2020-2027.**(2)

close to 12 million

These are the **active healthcare-related connections expected to** be in Europe by 2026

(1) Source: Centers for Disease Control and Prevention (CDC)

(2) Source: Fortune Business Insights. (2021). https://www.fortunebusinessinsights.com/industry-reports/telemedicine-market-101067

(3) Source: European Telecommunications Network (ETNO) https://etno.eu/library/reports/90-state-of-digi-2020.html