



Digital Health

Transforming Healthcare







Contents

How digital health can improve quality of life	5
Emerging trends in Healthcare industry affect all stakeholders.....	6
Innovative technologies contributing to digital health	7
Consumers are taking control of their health	7
Healthcare is moving towards personalization	7
Definition of healthcare is changing	7
Emerging technologies are becoming more important.....	7
Digital health is challenging, but Capgemini can help!.....	9
Case studies	10
Challenges and risks of digital health	12
Cybersecurity	12
Capgemini's help with improving cybersecurity.....	12
Changes in regulatory and compliance requirements	12
Initiatives to protect data	12
Capgemini's help with the protection of the patient's data	12
The necessity of a good establishment of technology infrastructure and a connected workforce	12
Conclusion	14

“The global digital market size is expected to expand from \$140 billion in 2018 to **\$380** billion in 2024¹.

The healthcare industry is facing an aging population, an increase of chronic diseases and a higher demand for cost-effective ways to provide qualitative care. These challenges can be addressed by digital technology.

In this white paper, we illustrate the added value of digital health in the healthcare industry. We focus on specific digital health themes including major trends, the regulatory and compliance landscape, the associated risks and challenges. Moreover, we showcase Capgemini's capabilities in digital health.



What is digital health

Digital health is the convergence of digital technologies to enhance the health and wellness of patients through effective, sustainable and personalized healthcare delivery. Considering digital health as 'The Holy Grail', companies need to stay ahead with the adoption of emerging technologies.



How digital health can improve quality of life

It has become evident that digital health technology allows for a more patient-centric approach. The role of these technologies has evolved tremendously over the last 20 years and will continue to disrupt healthcare in conjunction with our societal technological advancements.

Technology applications provide us the ability to store, share and analyze health related information and **improve quality of life of patients** in ways that could not have been imagined a decade ago.

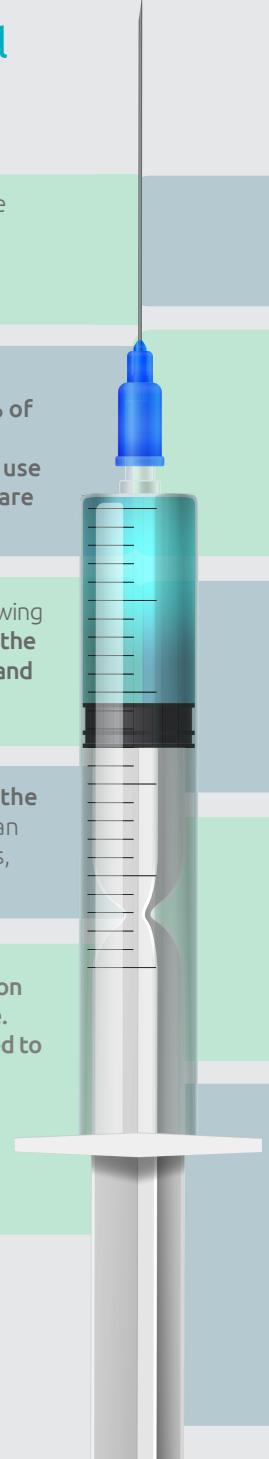
Technology can play an important part in reducing costs, facilitating patient access to their health data and improving care in general. It makes healthcare more intelligent, scalable and fast.

Digital health has become the cornerstone in our strategies to meet the healthcare challenges of the 21th century and beyond.

Digital technologies are transforming healthcare. From clinical research to clinical practice, there has been an explosion of new technologies revealing endless possibilities.



Emerging trends in the healthcare industry affect all stakeholders

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- There has been a transformation in healthcare from a provider-driven model towards a more patient-centric model. Patients expect to be at the center of the care being provided.²
 - **Patients are becoming more engaged and informed.** For the search engine Google, 5% of all searches are healthcare related. Furthermore, one out of two individuals will use a search engine before consulting a healthcare professional.
 - The healthcare industry is one of the fastest growing industries in the world. Expecting an **increase of the global spending of \$8.2 trillion between 2030 and 2040 (from \$16.04 trillion to \$24.24 trillion).**¹
 - Life expectancy will continue to increase in the industrialized countries by 2030, leading to an enormous impact on healthcare organizations, social services and pensions.⁴
 - By 2050, the global proportion of the population aged 60 years or older will be 2.1 billion people. Only in the year 2017, this population amounted to **962 million people.** This demographic shift will guarantee that all countries face the different challenges regarding the ageing population. We have to ensure that the health-and social systems are prepared for this shift.⁵
 - **Chronic diseases are rapidly increasing.** By 2020, it is expected that the occurrence of chronic diseases will increase with 57%.⁶
 - **Healthcare is moving towards the patient's home.** Telemedicine, wearables and the need for a more efficient care are the driving forces behind this movement. The global amount of **wearables is expected to reach over \$2 billion by 2024.**⁷
 - Allergies are becoming more prevalent in high-income countries. Today, 150 million EU citizens suffer from chronic allergic diseases and by 2025, **more than 50% of European citizens will suffer from allergies.**^{8,9}
 - Preventive care is gaining more and more attention in the healthcare industry. Preventive care will counterbalance risk factors of chronic diseases, will slow disease progression and will lead to an overall decrease of healthcare costs.
 - **Mental care is gaining ground.** Mental disorders are one of the greatest public health challenges of modern society. World wide, **depression** is one of the major mental disorders leading to suicide with an estimated death rate of **800.000 deaths per year.** It is predicted that by 2022, the behavioral/mental health software market size will reach **\$2.31 billion.**¹¹

Innovative technologies contributing to digital health

This is a non-comprehensive list of innovative technologies which could be applied within the digital health concept.

Consumers are taking control of their health

There is an increase in the requirement of self-health monitoring and preventive medicine, known as mHealth. By the year 2025, the market size of mHealth will be worth \$189 billion.¹³ One of the main reasons is the expansion of the ageing population that we are facing.

Self-health monitoring enables consumers to take control of their health by having the possibility to track everything, from knowing their amount of exercises to monitoring their eating habits. The use of wearables, hearables and sensors has made this all possible (Exhibit 1 & 2).

Healthcare is moving towards personalization

Due to the increase in the connected health, known as Telehealth, providers can deliver a more personalized care. Telehealth has made it possible to collect and share data about the patient's health. Important sources for sharing this data are EHR (Electronic Health Record) and IoT (Internet of Things) that enables providers and payors to adjust healthcare interventions to the needs of the patient.

With an estimated market size of \$38.29 billion by 2025, EHR will become one of the main sources for collecting data and optimizing digital health interventions (Exhibit 1 & 2).¹²

Definition of healthcare is changing

The definition of healthcare is changing due to a more centric and virtual care model. In addition, the change in the focus of the patient itself, that is now value and service based, has led to a change in the definition of healthcare. Patients are looking for better value-added services, improved communication and better channels of engagement. They are vocal and readily share their expectations.

Emerging technologies are becoming more important

The relationship between humans and technology is at an inflection point. Emerging technologies are becoming more important due to their disruptive and innovative character, which is the main reason for considering them as the future of healthcare.

Internet of Things

Internet of Things (IoT) is a network of internet-connected objects that can collect and exchange data with the use of sensors. Wearable devices are one of the most important IoT devices that have been well integrated into our daily lives. They are considered as reliable tools for long-term health monitoring systems.

By the year 2025, the estimated market size for IoT will reach up to \$933.62 billion, which indicates the important role of IoT (Exhibit 1).¹³

Artificial Intelligence

Artificial Intelligence (AI) is increasingly used to augment human capabilities and automate repeatable processes. The technology has the potential to do many tasks that humans do and, do them faster, better and cheaper. It has many advantages, including its cost effectiveness, the ability to rapidly process large data sets, its repeatability and reliability and its non-biased analysis.

For example, Google's DeepMind was not only able to beat the world champion of the strategic game GO, but was able to learn the game without direct human engagement. Radiology departments are adopting AI, and, in many cases, the technology is performing on par with trained clinicians. Furthermore, AI is being applied to early cancer detection and the initial results are promising.¹⁴

The maturation of the technology is happening at a faster rate than many anticipated. It is projected that AI will replace existing jobs but create 2.3 million jobs in 2020, leading to 2 million net-new jobs in 2025.¹⁵

We need to think through what this means for society and how to best prepare for the forthcoming transformation.

Combining IoT and AI

IoT delivers an enormous amount of data while AI processes an enormous amount of quantitative data, leading into actionable themes. The combination of IoT and AI will be able to reduce manual redundancy and to ensure fewer errors leading to a better quality of care.

3D printing

There is no doubt that 3D printing will strongly impact the pharmaceutical business model. This technology has been leveraged in numerous industries, including automotive, aviation and food. Nonetheless health care has always been a key area of innovation. As early as 1993, German scientists published an article focused on the use of 3D printing for reconstructive head surgery.¹⁶

In 2002, a miniature functional kidney was engineered. The technology has soared since then, and in 2008, the first patient was able to walk thanks to a prosthetic leg printed without any assembly.

SmartPill

A recently developed monitoring system for the gastrointestinal track is the SmartPill. It is used to diagnose and treat a disease from within the body. A miniature medical chip called ATMOS (Addressable Transmitters Operated as Magnetic Spins) is built within the pill. The medical chip measures the factors (pH, temperature, etc.) that indicate whether a patient is healthy or not. The measured information about the patient's health is sent to a doctor. If the patient is ill, there

can be a release of drugs to the precisely identified problem within the body that is provided by the chip.

Big data and analytics

Technology innovations from the open source community have created an unrestrained enthusiasm for what the entire world has come to know as Big Data. And it's not only about data science and next generation algorithms. It will provide more real value, closer to the business than ever before. The significant advancements of big data and analytics make it possible to make near certain predictions about the complications, the readmission and the outcome of a care plan devised for patients. Keep in mind: 'if you can't measure health, you can't improve it.'

Blockchain based systems

Blockchain is considered as one of the most important disruptions of digital health. It's the new player in the security neighborhood. How it plays out over the next year will be watched closely. However, it is safe to say that stay-

ing abreast of this trend will be important. More specific, it could be the next game changer due to, due to his potential to alleviate one of the major challenges of the industry namely transmission of data across geographies without compromising its privacy and security. The application of blockchain can have, a positive impact on member health management and provide a critical link in the support of medical tourism.

Chatbots

In summary, a chatbot delivers a simple chat interface and enables a conversation that can be guided by rules and potentially with artificial intelligence. Similar to Apps and Websites, chatbots can take different shapes and behavior. They are easier to adopt and easier to deploy. The increase of smartphones in developing countries together with the existing mobile phone usage rates and the decreasing cost of data will result in a huge potential for AI-based chatbots. These chatbots will be able to reach millions of additional patients. It thus becomes imperative for the life science companies to have chatbots.



Exhibit 1: Evaluation of the healthcare market^{16,22}

Digital health is challenging, but Capgemini can help!

Considering digital health as 'The Holy Grail', companies need to stay ahead with the adoption of emerging technologies. This requires a clear strategic direction to seize market and digital opportunities. Capgemini helps life sciences clients by helping them chart their **digital health strategy** leveraging insights on markets, customers and digital innovation, by use of our expertise and unique approach. From traditional to modern **analytics solutions**, Capgemini enables their customers to keep up with the

pace of change and empowers them to make faster, better-informed, and more accurate decisions. Digital health is a multi-disciplinary domain which involves different stakeholders, including clinicians, researchers and scientists. As integrator and through Capgemini's global presence, we assist clients in the development of such **interconnected health systems**, to aid healthcare practitioners and patients with managing health risks and promoting health & wellness. Moreover, our **Cyber Security** Department will help you to get electronically connected with the different stakeholders involved in the digital healthcare revolution, for sharing health information in a secure way. Capgemini has core expertise in most technology facets of digital health (Exhibit 2).

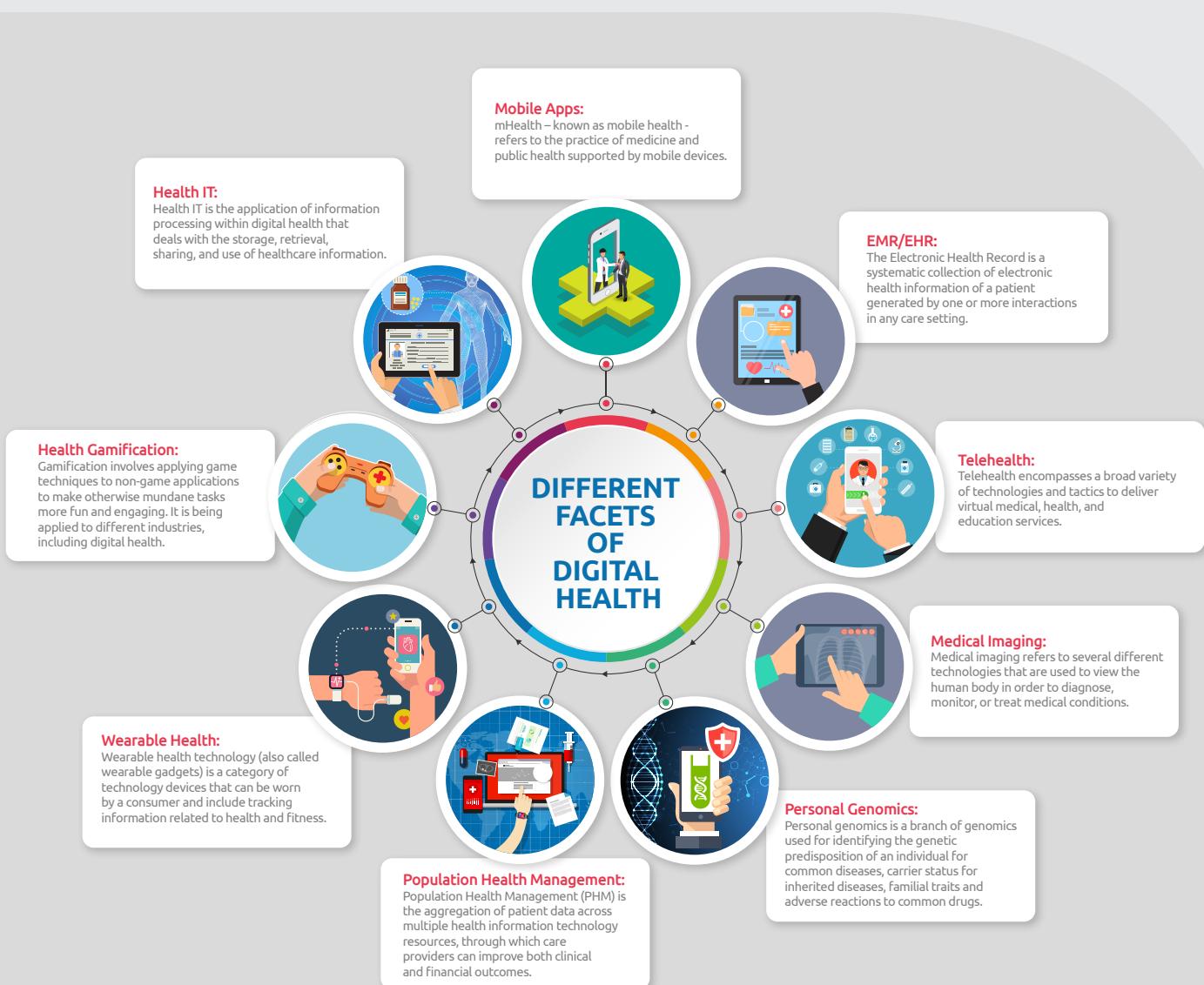


Exhibit 2: Different facets of Digital Health

Case studies

Design of an innovation blueprint for a pharmaceutical company

Challenges:

1. The client had **no clear view of innovation** and had **no formal mechanism** in place within the organization to enhance innovation as a process. While many initiatives within the organization were labelled with "innovation", there was **no consistent or repeatable form to drive growth**.
2. **The establishment of an innovation framework faced several barriers**, including a lack of understanding how innovation drives value, limited dedicated resources (balancing with "day jobs"), stagnate approval processes and not receiving incentives or rewards that were tied to the process.

Solutions provided by Capgemini:

- Capgemini was involved in **designing structure and high-level processes for an innovation blueprint** for the US oncology franchise.
- **Designed a mechanism that fosters the sharing of innovative ideas** that can be harnessed by the client's US oncology franchise.
- **Defined attributes that constitute an innovation blueprint** (scope, operational processes and structure, governance, investments including people and infrastructure).
- **Estimated the high-level investment and effort** required to launch and operate an innovation center.

Client benefits:

- This project served as a foundation for the organization to build an innovation process going forward.

Modernization of the customer relationship of a generic drug producer

Challenges:

1. **The company's market is strongly influenced by pharmacists** because they have an important role in prescribing / substituting. Considering that pharmacists satisfaction is a key issue.
2. **The Customer relationship suffered from the customer service that is provided, because this service only focused on claims.** For example, they had no customer experience, no homogenous segmentation or no stabilized customer data,

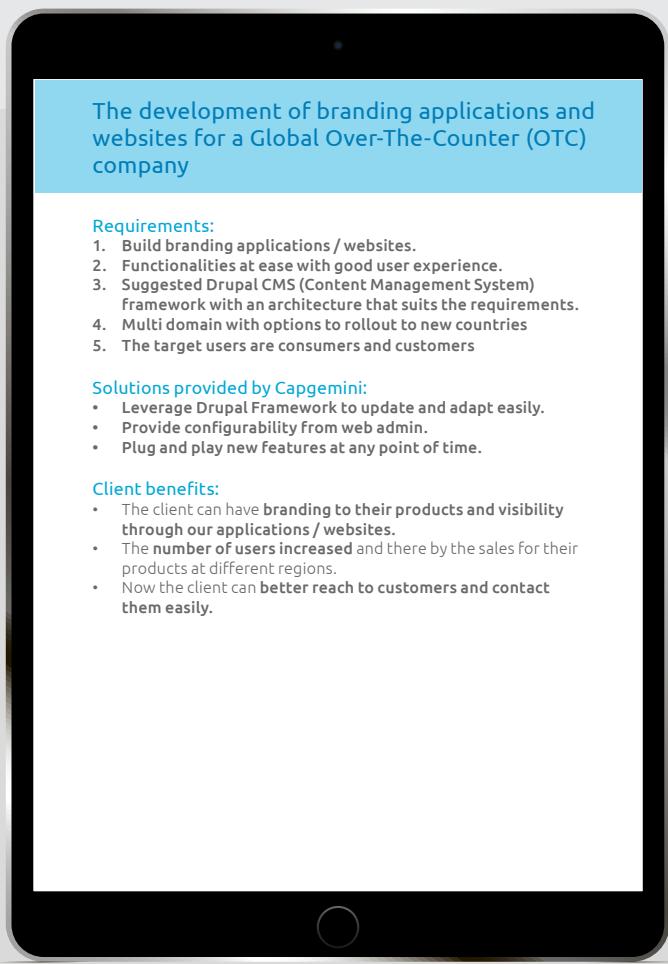
Solutions provided by Capgemini:

- **Redefined the marketing strategy** around the customer relationship in two ways:
 1. Depending on the client's typology.
 2. Based on a new customer experience.
- **Optimization of processes** to meet a better & coordinated execution.
- **Improvement of existing tools** used to support the Marketing Customer Relationship strategy.

Client benefits:

- A **shared comprehensive vision** of what exists and a clear and aligned vision of the required evolution.
- A **cross-functional program** between marketing, customer relationship and sales
- A **consistent organization** in which the core mission is the customer relationship.
- **New marketing needs are expressed and an implementation of training sessions** for new tools.
- An **Return On Investment culture** born thanks to Key Performance Indicator definition and monitoring.







Challenges and risks of digital health

Despite the benefits of digital health, development and deployment need to overcome multiple challenges and risks before widespread adoption can occur. The following challenges will play an important role in the adaptation of technology in the healthcare industry.

Cybersecurity

As the role of technology will increase in the healthcare industry, developers will deal with a higher demand of securing and managing the shared data. Every stage of development goes together with challenges. Currently, the healthcare industry and life science companies - like other sectors - are facing the threat of cybercrime. In the last couple of years, many leading healthcare stakeholders have lost millions of dollars due to data breaches. The magnitude and severity of the crimes are likely to increase over time when proactive mitigation steps are not taken. In such a scenario, the key stakeholders are shifting their focus towards secure, cloud-based platforms. Such platforms will not only help to maintain confidentiality, but also will support compliance with Health Insurance Portability and Accountability Act (HIPAA) regulations and improve overall efficiency. The regulators are already working on this important challenge, to ensure the safety of both the patients and their data by imposing rigorous standards on medical developers.²⁴

Capgemini's help with improving cybersecurity

We provide end-to-end advisory, protection and monitoring services to secure every organization. We advise on cybersecurity strategies depending on the current level of maturity to help you define a security perimeter, objectives and procedures. We protect your systems with our cybersecurity solutions and monitor to detect and react in advance of cyber-attacks.

Changes in regulatory and compliance requirements

Companies venturing into digital health must plan to address the regulatory and compliance requirements that their products should adhere to, on a cross-border basis. For example, connected medical devices where data can be accessed by multiple stakeholders, shall be subject to data protection & privacy regulations and e-commerce regulations, apart from the general medical device regulations.

Initiatives to protect data

Regulatory authorities across the globe are taking initiatives to support the digital health ecosystem.

The EU has the eHealth action plan, aligned with the Europe 2020 strategy to outline the vision and actions to implement digital health projects. Targeted initiatives like General Data Protection Regulation (GDPR) are being launched to keep in step with the digital technologies. GDPR is an initiative from the EU that provides EU citizens protection and security of their personal data that can be exported outside the EU or between the EU member states.

The US Food and Drug Administration (FDA) has recently introduced the 21st Century Cures Act that will be used to regulate medical software in addition to the traditional regulations like HIPAA and CAPA (Corrective and Preventive Actions).

Another initiative from the FDA is a setup of a pilot program with the aim of helping the revolutionization of a new digital health regulation regarding software precertification. Looking at the software or digital health developer instead of looking at the product itself will help to determine whether a company meets the quality standards and qualifies for pre-certification. The participants of this pilot study are technology and medical device companies such as Apple, Fitbit, Johnson & Johnson, Pear Therapeutics, Phosphorus, Roche, Basel, Samsung, Tidepool & Verily.²³

The changes in regulation requirements are also possessing another challenge for the developers of medical technology products. The EU regulators are working on an overarching standard to replace existing medical device directives that are necessary to ensure the patient's safety, which will be expected to have a tremendous cost of the compliance and regulations. Developers must keep this in mind when they are preparing for the research and development phase of their products.

Capgemini's help with the protection of the patient's data

Capgemini provides regulatory compliance as a part of its solution offerings and ensures that Digital Health solutions are ready to be certified on completion.

Capgemini recently helped one of its clients, a top pharmaceutical MNC with compliance analysis activities for multiple projects. These were conducted by our business analysts, who are thoroughly trained on compliance analysis procedures. The reduction of time in compliance analysis completion was between 15 days and 40 days. All the compliance analysis was culminated into projects and helped the client R&D IT team to have good visibility and appreciation.

The necessity of a good establishment of technology infrastructure and a connected workforce

To fully utilize the power of digital health, all the participants should be fully aware of its functionality. This requires digital savvy, a mentally and physically sound patient population and trained hospital staff.

Since technology is now easily accessible and at low cost, it should be ensured that it is "layman proof" and can handle technical glitches gracefully as sub-standard infrastructure could lead to life-threatening consequences.

If the standard is met, the industry wide equipment should be in place, so that the different stakeholders, who are using different kinds of equipment's, can communicate.

As described before (Capgemini has the solution for connecting all the stakeholders of digital health!) stakeholders should connect and work together to find themselves in a better place.



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Conclusion

The healthcare industry is facing some important challenges that can only be resolved by the help of technology. As technology is moving at a faster pace in the healthcare industry than ever imagined, life science companies need to stay ahead of this disruptive trend.

With the support of Capgemini, your company will be guided in the adaptation and implementation of these state-of-the-art technologies. As a result, you will provide better and smarter services that improve the quality of life of the patient.

We all have the same goal: People matter, results count!

About Capgemini

A global leader in consulting, technology services and digital transformation, Capgemini is at the forefront of innovation to address the entire breadth of clients' opportunities in the evolving world of cloud, digital and platforms. Building on its strong 50-year heritage and deep industry-specific expertise, Capgemini enables organizations to realize their business ambitions through an array of services from strategy to operations. Capgemini is driven by the conviction that the business value of technology comes from and through people. It is a multicultural company of 200,000 team members in over 40 countries. The Group reported 2016 global revenues of EUR 12.5 billion.

Learn more about us at

www.capgemini.com

People matter, results count.

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