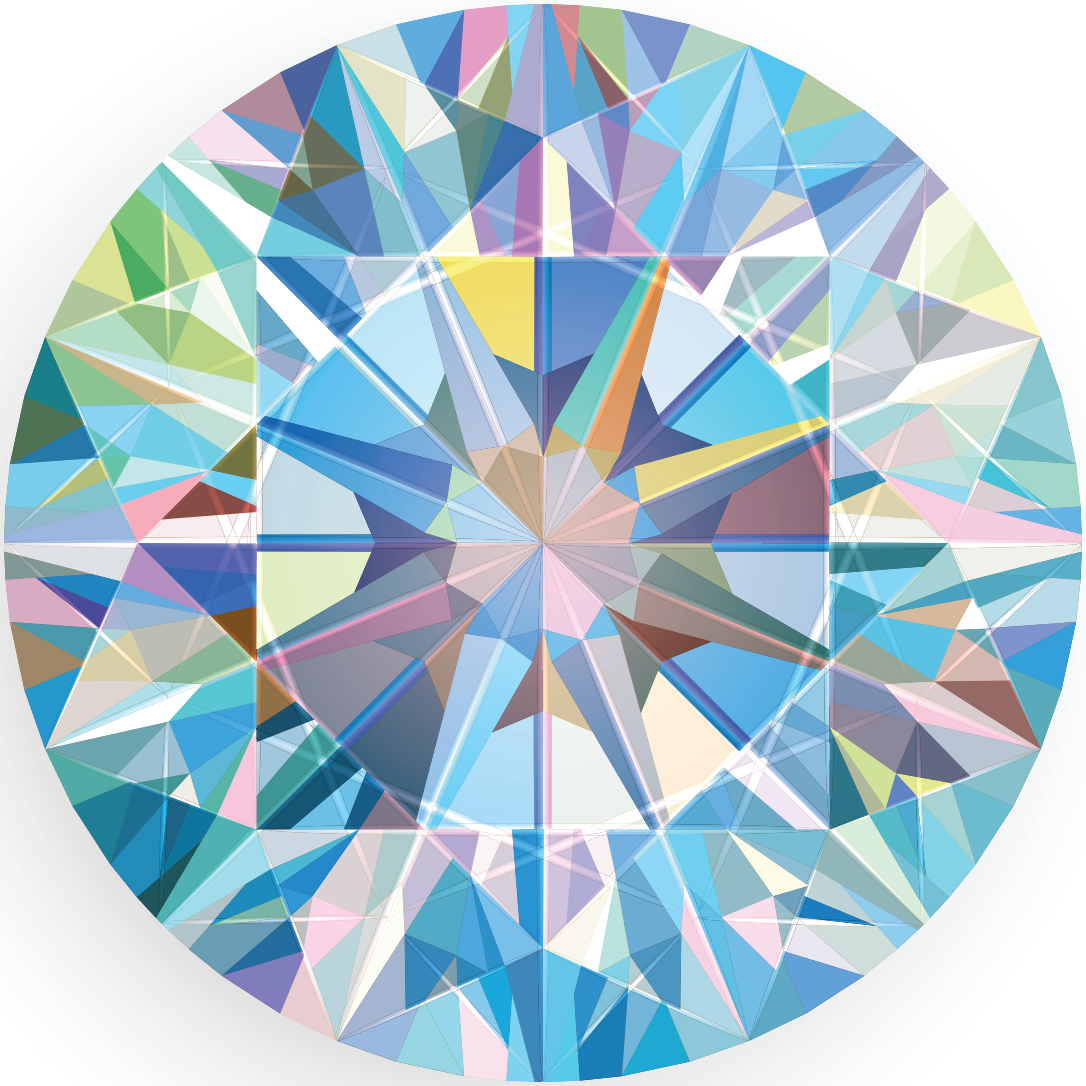


data-driven Life Brilliance:

Using data to create lives that shine with vitality

Deloitte Digital and Sales force joint White Paper

Contents

1. Introduction

■ In present-day Japan, the population is aging, and as of 2020, the percentage of people aged 65 or older makes up over 25% of the total population. In other words, we have already seen the advent of a society with a population in which one out of every four people is at least 65 years old. It seems certain that the super-aging of society will continue in the future, as well.

■ "Health" is the most important factor for each and every citizen, including the elderly, to be able to be socially active in a way that suits him or her, for as long as possible. However, the concept of health does no longer simply indicate the state of "not being ill"; it is considered to be shifting toward a constant state of "well-being", where the person is happy and fulfilled physically, psychologically, socially, spiritually, and economically. It is predicted that territories covered by healthcare will expand to reach a wide range of areas related to "well-being".

■ In response to the aforementioned trend, various solutions from healthcare-related digital technologies ("digital health") are expected to appear and spread at an unprecedented speed in the future. Cutting-edge technologies such as IoT/ICT/AI/xR will transform every part of the healthcare value chain, as well as empowering citizens and encouraging them to change their behavior in pursuit of well-being.

■ What form will healthcare take in 2040 after these changes? And what actions will be taken by citizens and the players surrounding them? What should we do now in anticipation of this impending future? In this document, we will investigate the outlook for the vision of the future of healthcare in 2040, and then examine the overall picture of the transformation currently taking place in healthcare while introducing actual case studies as examples. Finally, we will give advice regarding issues that may become risks for achieving transformation and countermeasures against them, as well as actions to be taken by each player in the future.

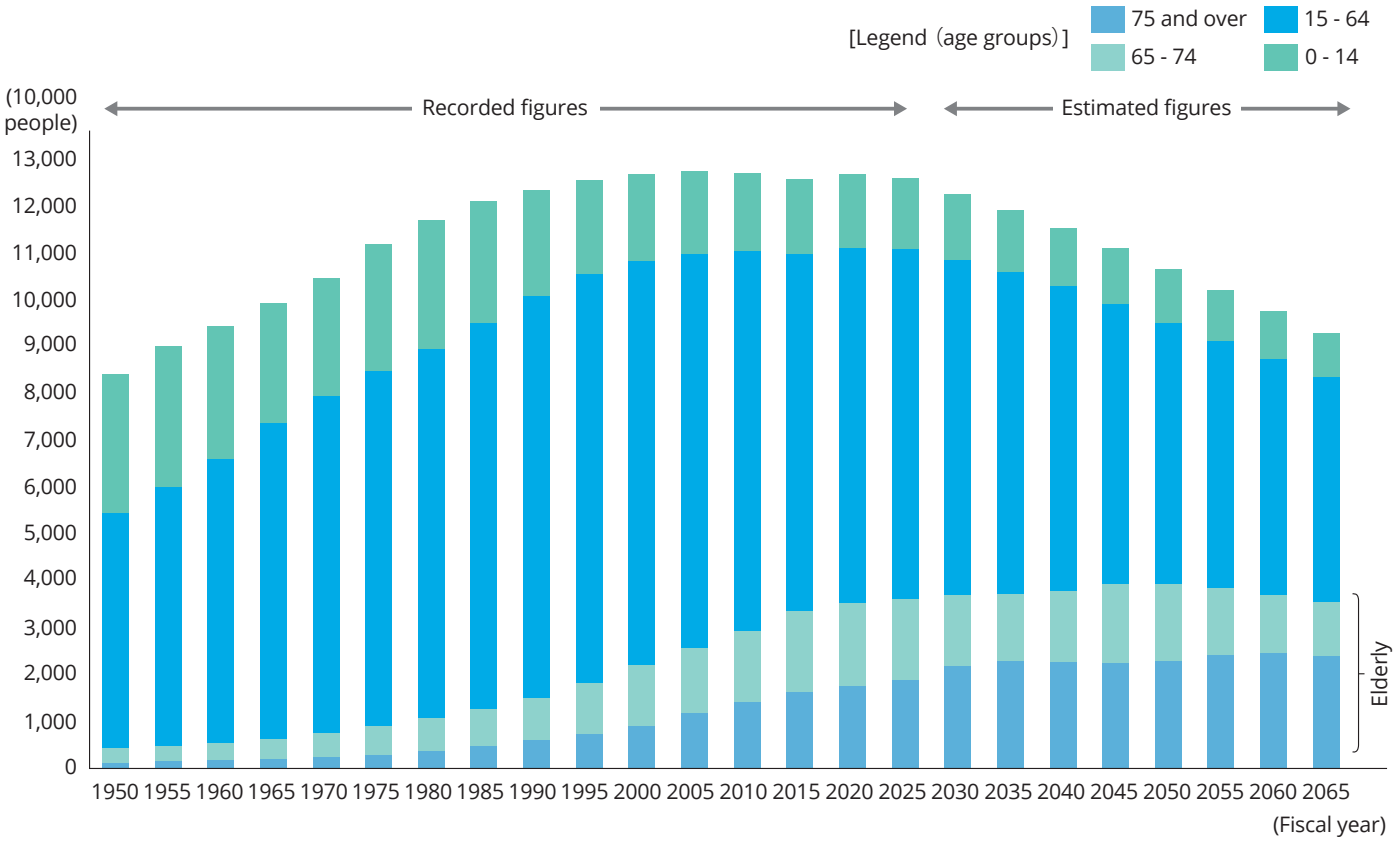
2. The “vision of the future” for healthcare in 2040

2.1. Entering a "super-aged society"

Japan's population peaked at 128.08 million in 2008 and has continued to decline year by year. It is expected to reach about 110 million by 2040 and to fall below 100 million by 2053. In the future, the population of people aged 65 and over will peak in 2040, but the aging rate (which indicates the percentage of the population aged 65 and over) will continue to increase. According to the WHO definition, a society with an aging rate of 21% or more is a super-aged society. By this definition, Japan could be called a super-aged society, as its aging rate has already exceeded 25% as of 2020.

With the super-aging of society, expenditures toward social security benefits will also continue to increase. According to the "Future Outlook for Social Security in 2040" published by the Cabinet Secretariat, the Cabinet Office, the Ministry of Finance, and the Ministry of Health, Labour and Welfare in May 2018, expenditures for social security benefits are estimated to increase from 121.3 trillion yen in FY2018 to 188.2 trillion yen in FY2040 (approximately 1.5 times). The breakdown shows the increases for various areas compared to current expenditures: "pension" is about 1.3 times; "medical care" is about 1.7 times; "nursing care" is about 2.4 times; and "children/childcare" is about 1.7 times.

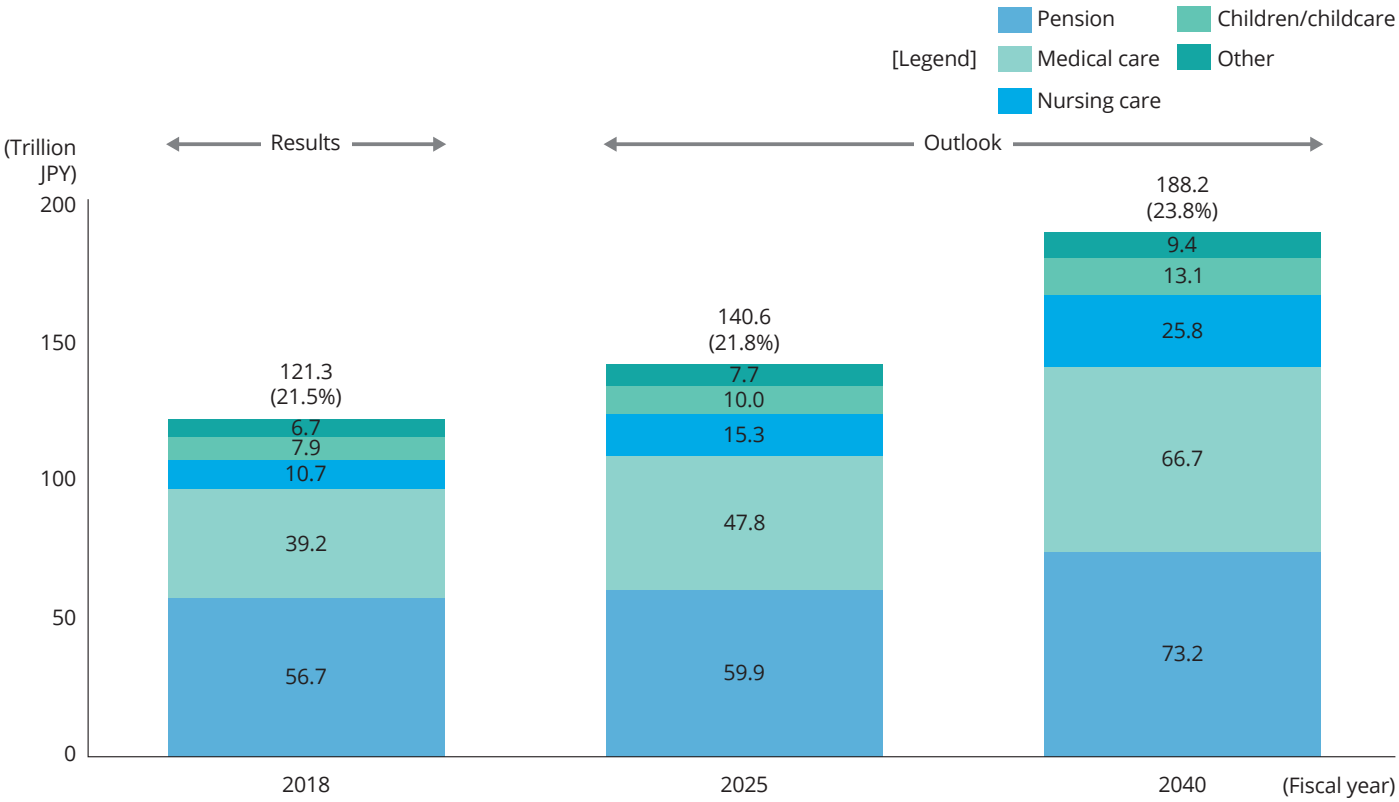
Figure 1: Trends in Japan's future population and composition by generation



Sources: The "National Census" was used for 1950 - 2015 figures; "Estimate of the Population" for 2020; figures from 2025 were prepared by Deloitte Tohmatsu Consulting based on the estimates for birth (median) and death (median) from the "Future Projected Population of Japan (2017 Projection)" (National Institute of Social Security and Population Studies)

There is no guarantee that the current social security system, in which the younger generation supports the many sizable social security expenditures, will continue to function when the current younger generation become the elderly themselves. It is also said that without some kind of solution, Japan will eventually face economic collapse. The key to coping with such a situation will be to maximize so-called healthy life expectancy of each and every person, including the elderly, so that they can lead healthy lives for as long as possible.

Figure 2: Forecast of social security benefit expenditures

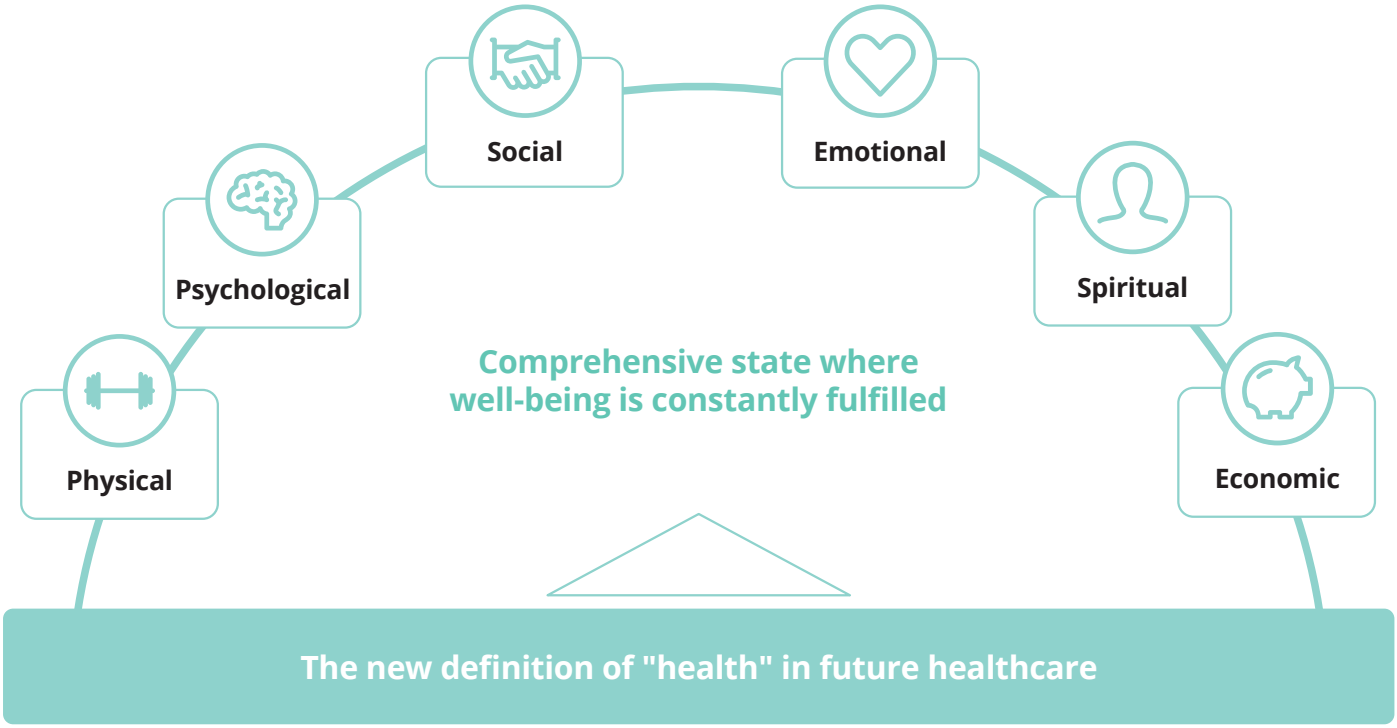


Sources: Prepared by Deloitte Tohmatsu Consulting based on "Current Status and Future Outlook of Social Security Expenditures" (Ministry of Health, Labour and Welfare)
*Figures in ( ) represent expenditure-to-GDP ratios

2.2. The shifting concepts of “health” and “healthcare”

In this kind of society, the definition of “health” that healthcare aims for will no longer simply indicate the state of “not being ill” or of “curing diseases”. In order for each and every citizen to be socially active in a way that suits him or her, for as long as possible, it will be necessary to achieve a constant state of “well-being”, where the person is happy and fulfilled physically, psychologically, emotionally, socially, spiritually, and economically. Accompanying this shift, it is predicted that territories handled by healthcare will go far beyond to scope of existing “treatment” and “disease prevention” areas and continue to spread to all areas related to the aforementioned well-being.

Figure 3: Shifting areas covered by healthcare

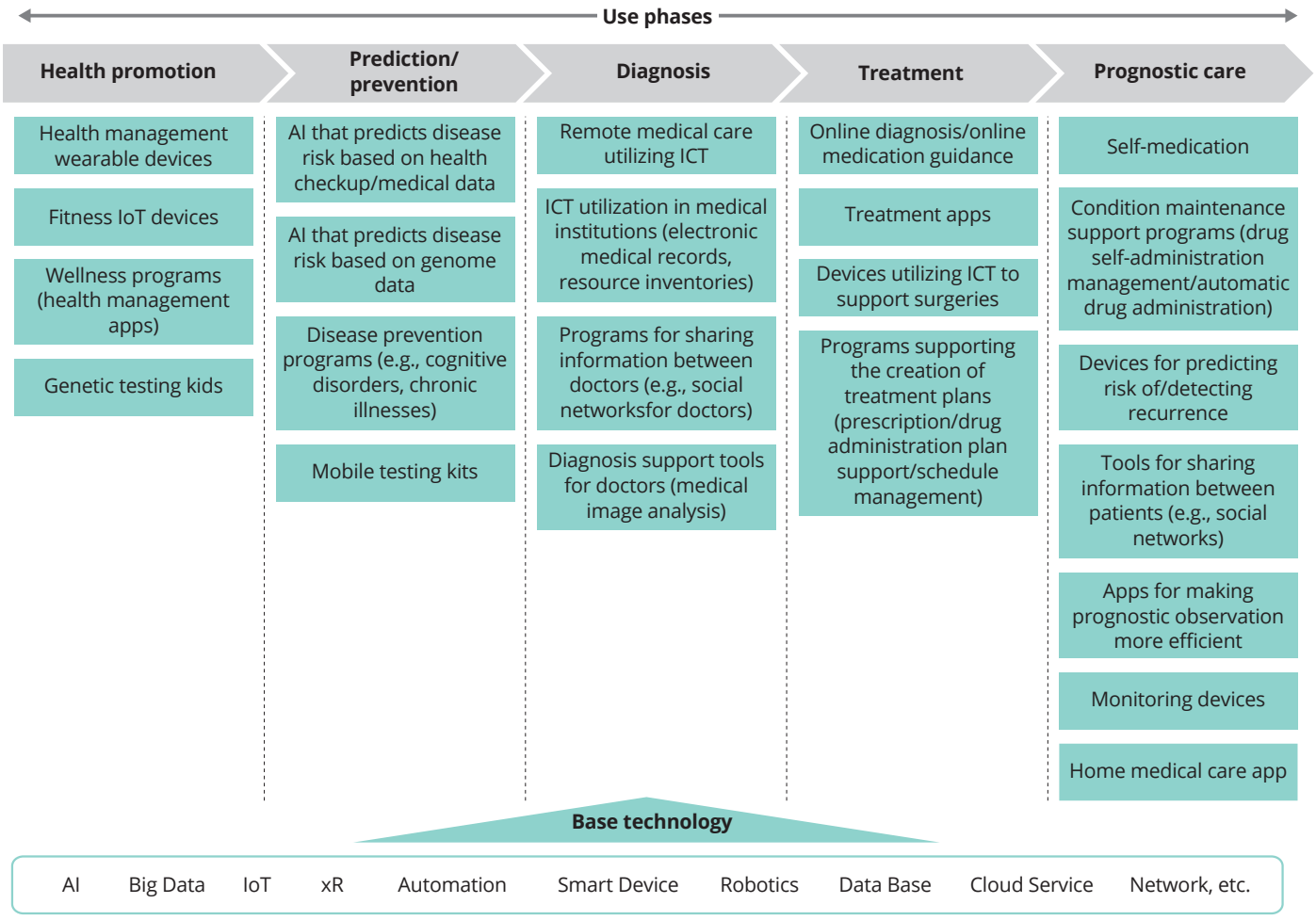


2.3. Spread and development of "digital health"

In recent years, healthcare-related digital technologies have made remarkable progress in response to the growing health consciousness of citizens. Innovations in the healthcare business that utilize cutting-edge digital technologies such as ICT, AI, and the IoT are collectively referred to as "digital health" or "health tech" (we use the term "digital health" in this document)*1.

Digital health is a concept that encompasses advanced diagnostic and treatment support used in medical institutions, such as medical image diagnosis AI and surgical support devices, and mechanisms for back-office efficiency, such as electronic medical record systems. In addition to these, it also includes products and services for health management and promotion that can be easily used by ordinary consumers, such as smartwatches that can manage data for vital signs such as heart rates. Additionally, with the recent COVID-19 pandemic, there are high expectations for the development and diffusion of telemedicine-related technologies (online medical care, electronic prescriptions, teleoperated robots, etc.) to minimize the risk of infection among patients and improve the efficiency for use of medical resources.

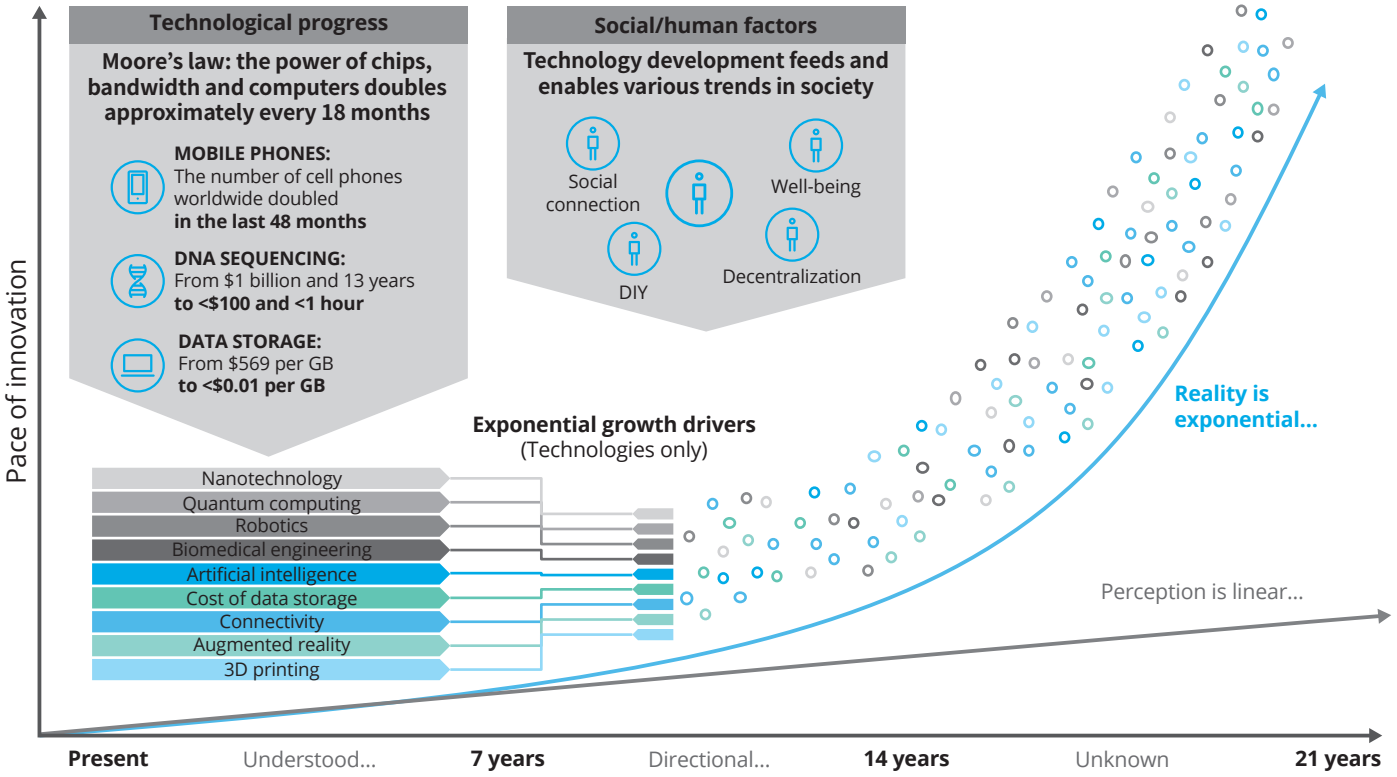
Figure 4: Digital health solutions (examples)



*1: The U.S. FDA's definition of digital health is as follows: "Digital health technologies use computing platforms (hardware, OS, etc.), connectivity (networks, etc.), software, and sensors for health care and related uses. These technologies span a wide range of uses, from applications in general wellness to applications as a medical equipment. They include technologies intended for use as a medical product, in a medical product, as companion diagnostics, or as an adjunct to other medical products (devices, drugs, and biologics). They may also be used to develop or study medical products. (Reference URL: https://www.fda.gov/medical- devices/digital-health-center-excellence/what-digital-health)

Most of the digital technologies that are transforming healthcare are still under development or are just beginning to be put into practical use. However, the speed of their spread and penetration in the future is likely to be exponential - much faster than we have been predicting. From a global perspective, while it took decades for automobiles and consumer electronics to gain popularity, cell phones and the internet have become commonplace in just over a decade. Approximately five years after smartphones and tablets arrived on the market, everyone was using them. In this way, the evolution and spread of advanced technologies is moving forward at an accelerating pace. The cutting-edge digital technologies we have just mentioned are expected to rapidly bring significant changes to the entirety of healthcare in the future.

Figure 5: The exponential growth and spread of digital health

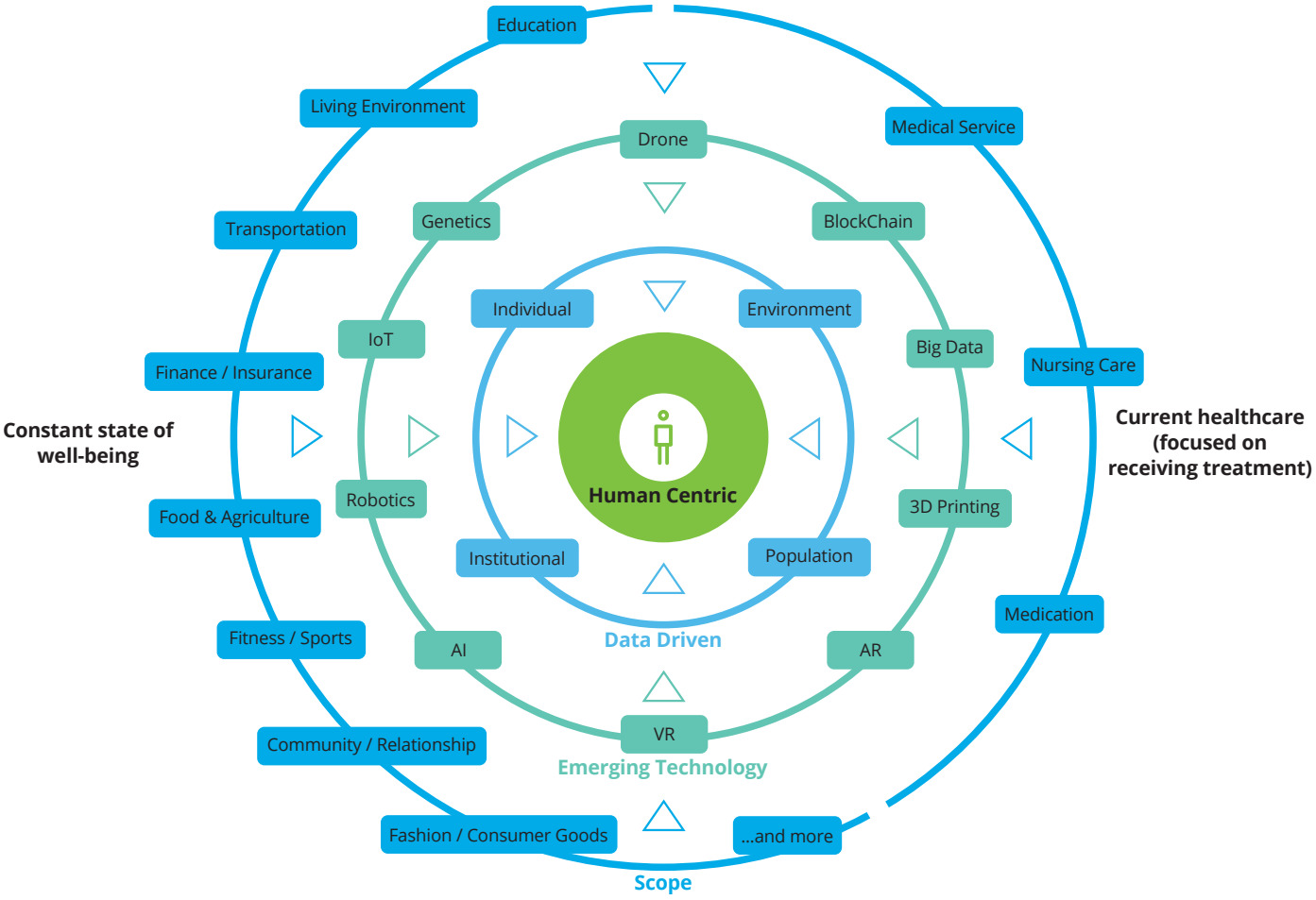


2.4. The “vision of the future” for healthcare in 2040

What will healthcare look like in 2040, when citizens’ concept of “health” shifts in line with demographic changes, and digital health technologies increase and spread at an accelerated pace in response to this?
First, by 2040, it is predicted that a massive, open and highly secure data platform will be formed on which data collected from all kinds of devices will interoperate in real time. As a result of this, healthcare may take the following form: all kinds of data from individuals, communities, and society as a whole will be collected, analyzed, and fed back in real time via digital health solutions, and citizens will be able to easily access these data and data-based healthcare services to independently and comprehensively manage their own well-being. This “vision of the future” will be common over the entire world, and not only for Japan – especially for all developed countries where super-aging is becoming increasingly serious.

For example, it may be possible to provide a higher level of personalized medicine by collecting and analyzing not only individual medical bill data and health checkup data, but also data on daily vital signs, lifestyle habits, and living environment, and then integrating this information with conventional pharmaceutical treatment. In addition, people may be able to use data for daily vital signs (or other data such as for voice or facial expression) to perform emotional analysis and be given a visual representation of their own psychological stress levels, or easily receive psychological counseling for stress care online. There may also be online coaches who are assigned to each individual to give advice not only in traditional healthcare areas, but also on optimized career and financial plans based on the person’s own life plan and data regarding future health risks.

Figure 6: The "vision of the future" of healthcare



Human Centric

Citizens act autonomously to make decisions for maintaining their own well-being or receiving treatment

Data Driven

Insight based on all kinds of data (e.g., biological, individual, institutional, population, environmental) is used as input for decision making

Emerging Technology

The newest interdisciplinary technologies, such as AI/Robotics/Drones/xR, are made the most of in order to expand human capabilities

Scope

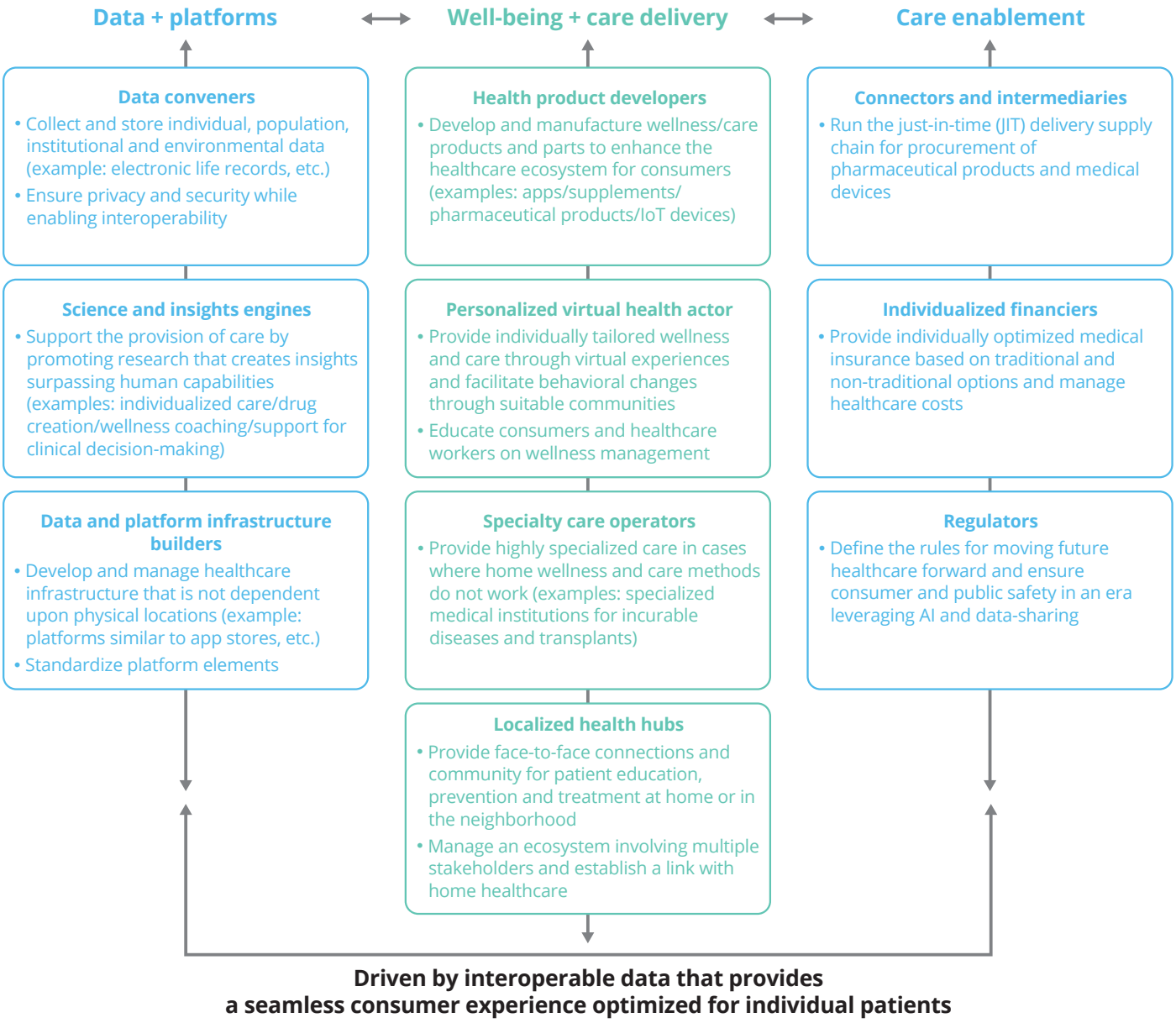
The sense of direction is moving from the current state of healthcare (focused on receiving treatment) to comprehensive "well-being"

2.5. The 10 archetypes that make up future healthcare

As already mentioned, future healthcare is expected to cover an extremely wide range of areas surrounding the well-being of citizens, and conventional medicine (prevention, diagnosis, and treatment of diseases) will be only a small part of it. The archetypes of the businesses that make up this broad market can be summarized in the following three categories and 10 types.

1. Data + platforms-related:
Data and platform-related businesses will be the core for realizing future healthcare. It is predicted that the following players will form mutual partnerships: the "data conveners", which securely collect and store various data that surrounds people, such as data for individuals, populations, institutions, environments and so on, in a form enabling interoperability; "science and insights engines", which provide technology for using vast amounts of data to create useful insights surpassing human capabilities; "data and platform infrastructure builders", which lay down the infrastructure for data management platforms and promote standardization.

Figure 7: The 10 business archetypes forming (the future vision of) healthcare



2. Well-being + care delivery-related:

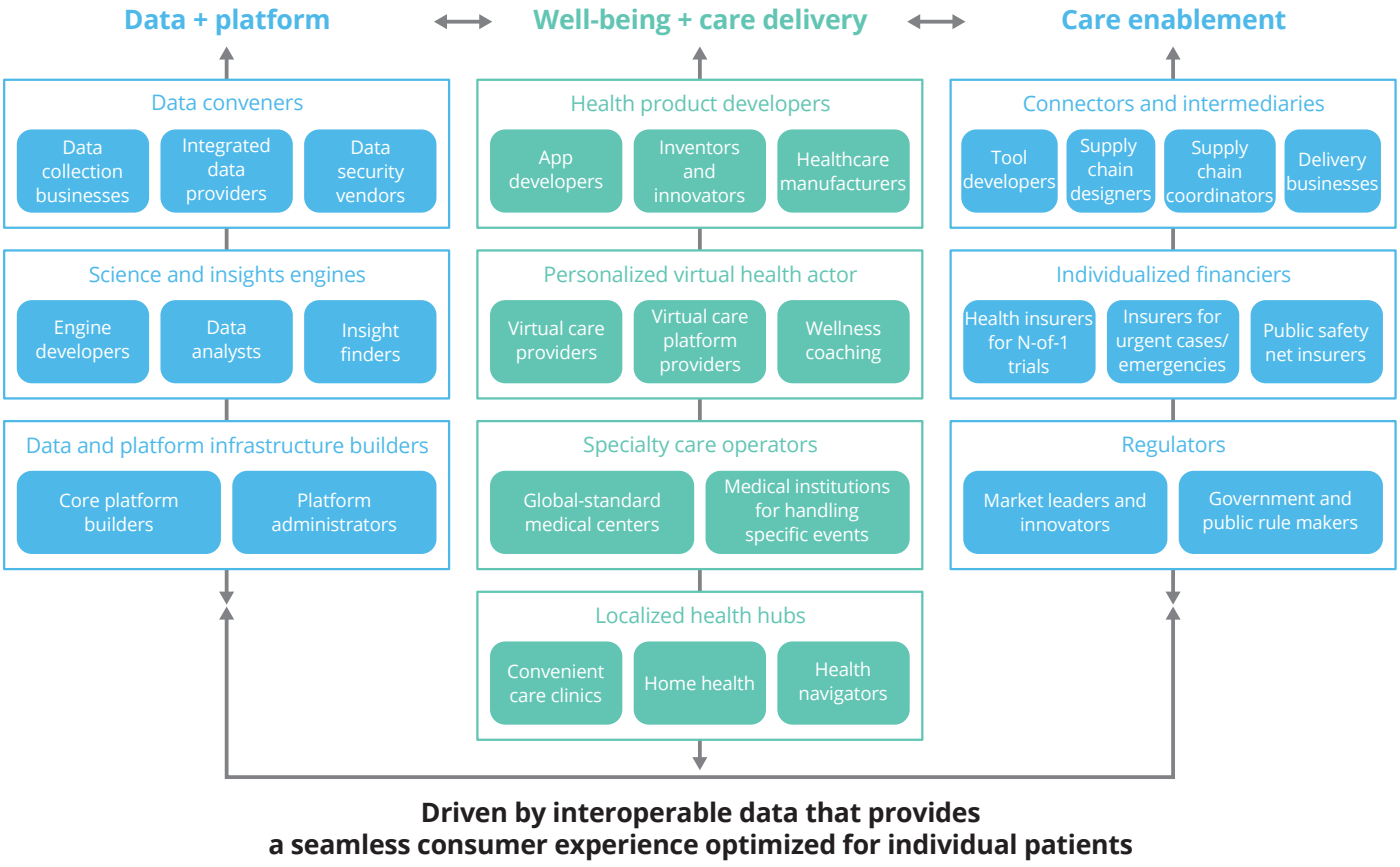
Next are the business archetypes that directly and indirectly support citizens in managing and pursuing their own well-being based on data. First of all, it is likely that we will continue to see traditional businesses in which "health product developers" offer wellness care products such as pharmaceuticals and medical equipment. It is believed that they will work on shedding light on disease mechanisms and developing innovative drugs and medical equipment based on them by providing feedback on the vast amounts of data accumulated by data platforms/data lakes to utilize in research and development.

Next, it is predicted that "personalized virtual health actor" will use online virtual experiences/communication utilizing AR, VR, and similar technologies to provide wellness and care tailored to individuals. If the virtual/online wellness and care described above does not work, traditional "specialty care operators" will be responsible for implementing highly specialized care. "Localized health hubs" will also play an important role in providing face-to-face connections and communities to follow up on citizens who tend to be isolated if they only have access to virtual or online interactions.

3. Care enablement-related

Finally, there is a group of business archetypes that work behind the scenes to form and operate the mechanisms ensuring that care is provided to those who need it in a timely and appropriate manner. First are the "connectors and intermediaries" who run the just-in-time (JIT) delivery supply chain including players such as pharmaceutical wholesalers. Next, "individualized financiers" are expected to provide medical insurance optimized for individual citizens with the aim of optimizing the cost of health care. This is based on the assumption that the current governmental universal health insurance system will shift to public-private partnerships in the future. Finally, governments and market leaders will act as "regulators" to promote the examination and formation of market rules that achieve both convenience and safety for citizens.

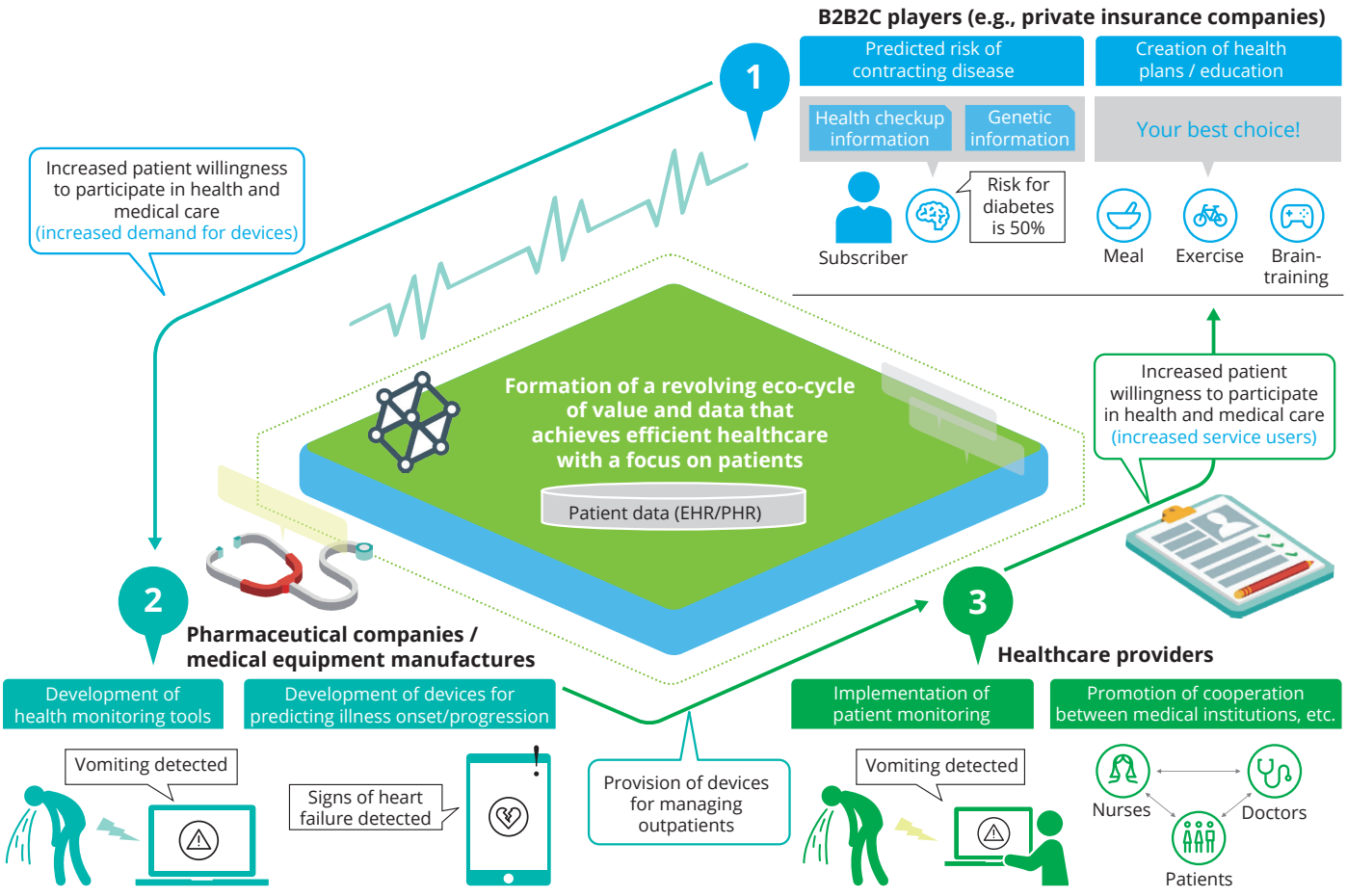
Figure 8: Business classifications for each archetype (examples)



2.6. Formation of a revolving eco-cycle

The following two elements are deemed crucial for the "future vision" of healthcare in 2040: the formation of a massive data platform for collecting and analyzing all kinds of data concerning citizens; and changes in attitude/behavioral changes leading to citizens using data and data-based insights to autonomously and comprehensively manage their own well-being. These two elements will not be achieved overnight; they will be gradual changes taking place over a medium- to long-term timespan of five to ten years. These changes will be led mainly by the following existing core players: B2B2C players (e.g., private insurance companies), pharmaceutical companies/medical equipment manufacturers, and healthcare providers (e.g., medical institutions).

Figure 9: Formation of a revolving eco-cycle lead by core players



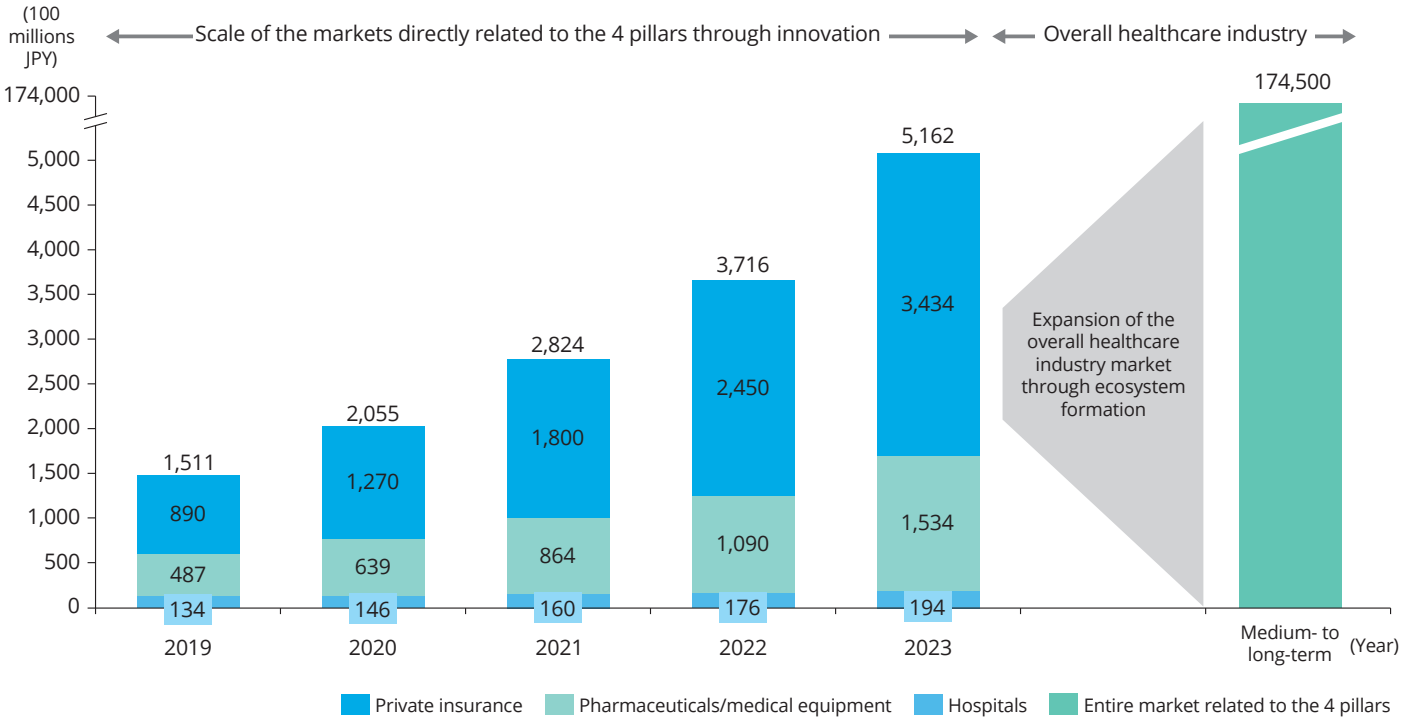
Specifically, first, (1) B2B2C players such as public insurers and private insurance companies will take the initiative in making efforts such as using health checkup data, registry data, and similar to predict patients' risk for disease and create health plans/ educate patients based on these predictions. This will stimulate patients to participate more actively in health and medical care. Next, (2) for patients with high motivation toward taking care of their daily health using devices and similar tools, pharmaceutical and medical equipment companies will collaborate with new entrants to develop and provide health monitoring tools and devices that predict the onset and severity of illness, and encourage their use. Then, (3) healthcare providers such as medical institutions will refer to the collected data to provide medical services, which will enable patients to find even more meaning in using digital tools to maintain and improve their own health.

As we continue to make these loops through the eco-cycle, a massive platform that collects and analyzes data will be gradually integrated and formed, and citizens attitudes and behavior will change, as well.

2.7. The massive healthcare market created by the formation of a revolving eco-cycle

As the revolving eco-cycle described above continues to form, the healthcare market will explode in scale. In the short term, the healthcare market will be driven by four main pillars (private insurance, pharmaceutical manufacturers, medical equipment manufacturers, and hospitals), but estimates suggest that the market will grow from 200 billion yen in 2020 to 500 billion yen in 2023, three years later. In the medium- to long-term, a market of 17 trillion yen is expected to be created by the entry of various companies from the finance, real estate and automobile industries into initiatives related to well-being.

Figure 10: Forecasted healthcare market size



1: The figures for the private insurance market are estimates from the InsurTech market. Source: https://it.impress.co.jp/articles/-/19468
2: The figures for the pharmaceuticals/medical equipment market are estimates from the mobile health market and RWD market. The former was estimated by multiplying Statista's estimated global market size by the percentage that the Japanese pharmaceutical market occupies in the global market. The latter was estimated by multiplying Verified Market Research's estimated global market size by the percentage that the Japanese pharmaceutical market occupies in the global market.
3: The hospital market figures are the total for cloud-format electronic medical records, telemedicine systems/services, monitoring systems for remote nursing/home medical care, and community-based integrated care systems / multi-professional collaboration systems, and were estimated by Deloitte Tohmatsu Consulting based on Fuji Keizai's amounts in their 2017 outlook and 2025 forecast.
4: Estimated results from the "Future direction of the next-generation healthcare industry council" (Ministry of Economy, Trade and Industry). Scope: the entire healthcare industry (the group of industries that provide services not covered by public insurance; the figures are the total for the market related to the four pillars and is composed of the following: health and productivity management, knowledge, measurement, exercise, food, prevention and insurance)

3. Leading case studies from overseas

The pursuit of well-being and the maximization of healthy life expectancy through the use of digital technology is a challenge that is not limited to Japan, but one shared by all developed countries. The need for voluntary health management by citizens has long been recognized as a serious issue particularly in the U.S., where a universal health insurance system has not been introduced, and individualized healthcare services utilizing digital technology are becoming increasingly popular. In this section, we will introduce particularly advanced case studies from Salesforce initiatives.

3.1. Case study (1): Company A, one of the world's largest biotechnology company - Co-Active patient engagement through patient support programs

Company A is one of the world's largest biotechnology companies, and has its head office in the U.S. In order to enable patients to more effectively use the pharmaceutical products it offers, it provides a patient engagement platform with the most advanced technology in the industry, utilizing various healthcare solutions from Deloitte and Salesforce (ConvergeHEALTH™ Connect for Life Sciences, Health Cloud, Salesforce Marketing Cloud, MuleSoft). Company A is a leading drug developer, but it had not built a sufficient mechanism for providing integrated services to patients using its pharmaceutical products. Company A leverages the 360-degree patient viewing function from Salesforce Health Cloud*2 to integrate information for each individual patient over the entire company. By using MuleSoft to link with various systems and narrowing down targets further through Marketing Cloud, it is now able to communicate with patients and conduct marketing campaigns through multiple channels*3. In addition, it has implemented a variety of real-time patient support programs (program registration, application for financial aid, field nurse support, program management, appointment reminders). The use of this platform has enabled Company A to 1) achieve increased medication adherence and improved functions; 2) achieve continuous improvements to the health status of its patients through giving patients and their families real-time access to their own health status and encouraging proactive behavior; and 3) form close partnerships with the healthcare providers ("HCPs") Company A is involved with to significantly reduce their office work related to pharmaceutical products and provide integrated and optimized treatments and services to its patients.

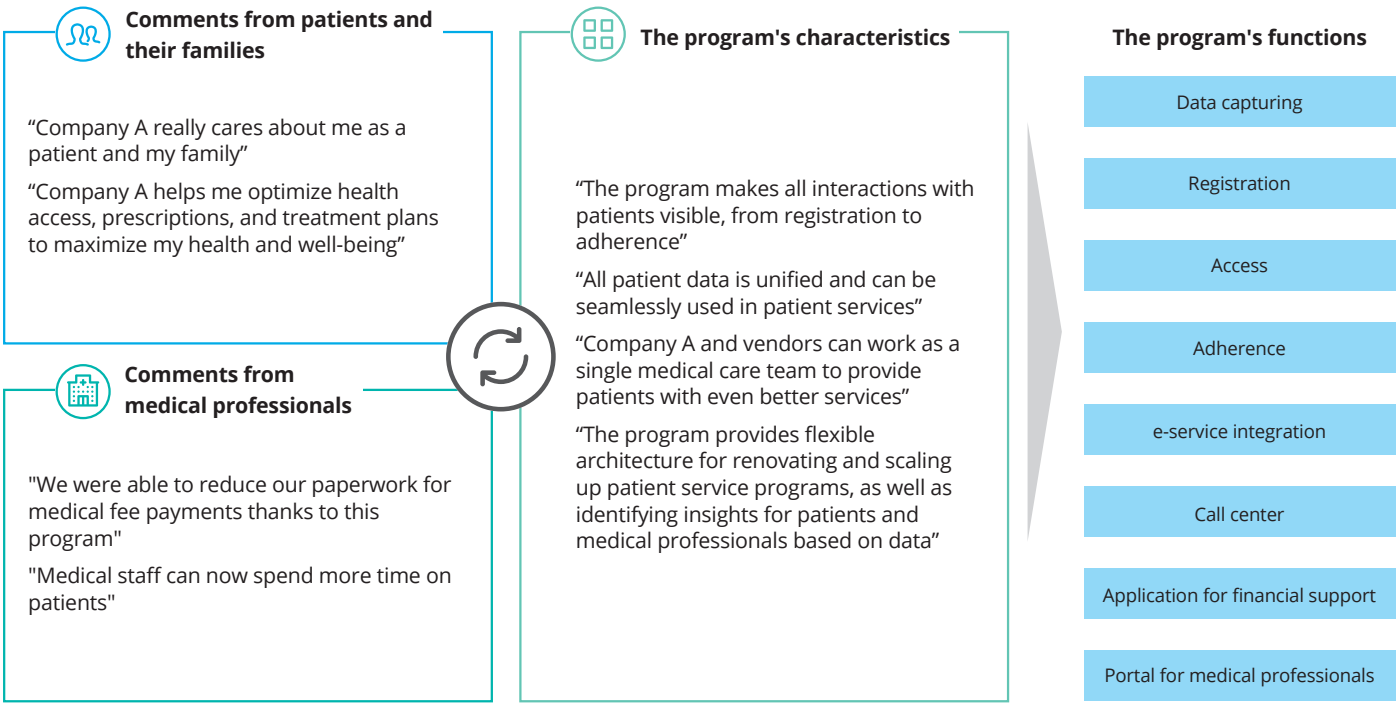
The program has already been rolled out in six countries, and this more comprehensive patient engagement is achieving even more palpable improvements in patient health status. This has resulted in reduced marketing and customer service costs for communication with patients.

*2: Health Cloud is a Salesforce solution designed specifically for the healthcare and life science industries for the centralized management of patient information, information regarding care for said patients, and information concerning the medical personnel involved in this care. It enables medical personnel to work actively and continuously to provide the optimal care to patients while strengthening cooperation among medical teams, thereby improving patients' QOL.

*3: Similar initiatives in Japan are subject to the application of the Next-Generation Medical Infrastructure Act (published in May 2017 and made effective in May 2018) from the perspective of protecting the rights and interests of individuals and the smooth and fair utilization of medical information. See Section 5.1 for details.

Additionally, after the outbreak of COVID-19, Company A had over 20,000 of its staff transition to working remotely. Its collaboration with Salesforce and use of digital experience solutions (Quip, Chatter, Experience Cloud) enabled it to swiftly achieve remote working on a large scale, as well as succeed in increasing employee engagement to higher levels than seen previously. By using Salesforce's Work.com application, it was also able to manage employees' health status digitally and make data visible, thereby enabling management and on-site managers to direct operations while ensuring safe conditions.

Figure 11: Overview of Company A's patient support programs



3.2. Case study (2): NYU Langone Health - Patient-centered operational reforms for a large-scale medical institution

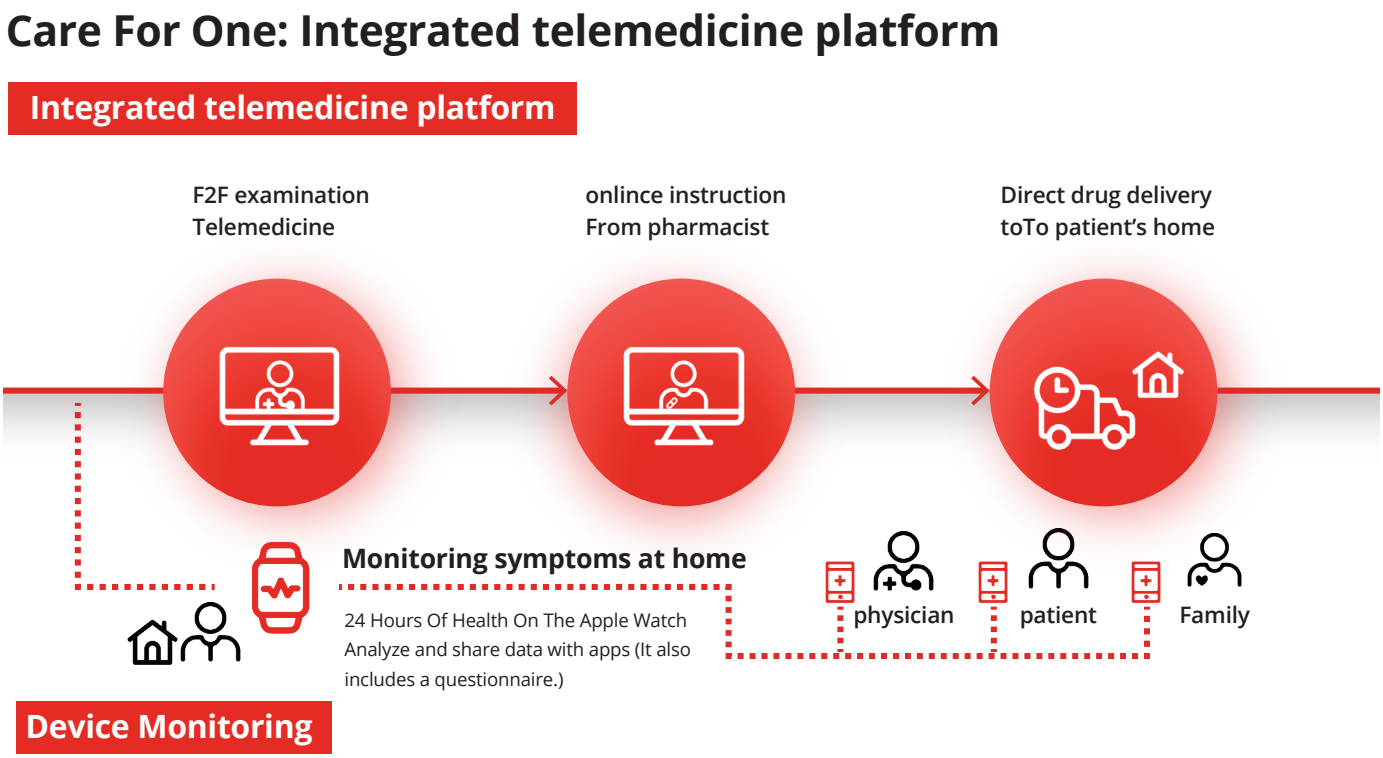
New York University ("NYU") Langone Health medical center is a large medical institution representing New York City, and provides a variety of medical services to a large number of patients. NYU Langone launched a patient access center with the aim of providing better customer service to patients, but with 2.2 million calls per year, it faced a challenge in figuring out how to centralize patient information and make customer service, care, and paperwork more efficient and patient-centric.
To tackle this challenge, the medical center centralized patient information using Salesforce's Health Cloud and used MuleSoft to link medical systems such as electronic medical records with data, thereby significantly improving the quality and speed of its responses toward patients. Immediately after patients call, patient access center personnel are able to use one location to confirm all information about the patient, including medical history, insurance information, schedule appointments, and preferences. Data, including electronic medical records, are available in real-time, allowing personnel to access accurate and up-to-date patient information at unprecedented speeds while on the phone with patients. This allows personnel to have an almost complete understanding of the patient's status/history, which reduces waiting time and increases patient satisfaction while at the same time leading to significant cost reductions. It also allows personnel to make active suggestions regarding the best action for patients to take next based on information from previous treatments. The medical center also uses e-mail, chat, and video calls for communication.
Today's patients expect a higher level of customer service, and the medical center aims to continue being patients' medical institution of choice by constantly striving to provide even better medical care and customer service.

4. Leading case studies from Japan

Japan is also beginning initiatives toward creating a revolving eco-cycle. Here, we will introduce the case study of Takeda Pharmaceutical Company Limited, the largest pharmaceutical company in Japan.

4.1. Case study (3): Takeda Pharmaceutical Company Limited

Takeda Pharmaceutical Company Limited is a leading player in the healthcare and life sciences industry, promoting advanced initiatives around the world. In 2020, the company began a study targeted at Parkinson's disease patients in Kanagawa Prefecture for a completely integrated online care system that includes at-home monitoring using Apple Watch*4, medication guidance, and prescription medication delivery. This initiative is a pilot project under the Agreement on Collaboration and Cooperation Related to Enhancing Regional Healthcare and Normalizing Medical Costs signed by Kanagawa Prefecture and the company in September 2019. The purpose of the clinical study is to examine the satisfaction levels of users (patients, caregivers, doctors, medical institutions, and pharmacists) and issues for implementation of the online platform. Several medical institutions in Kanagawa Prefecture are participating in the study.



Provided by Takeda Pharmaceutical Company Limited

*4: Apple Watch is a trademark of Apple Inc.

Additionally, in this clinical study, Takeda created an environment enabling Parkinson's disease patients who have difficulty visiting hospitals to sufficiently manage their disease from home in collaboration with various companies with the main focus on monitoring symptoms (e.g., tremors, dyskinesia) using a wearable device with a specialized application. Salesforce's Health Cloud has been employed to comprehensively manage and analyze patient information, and a data platform was built using the digital technology for treating central nervous system diseases common among the elderly.
In Japan, the spread of COVID-19 has led to advancing transformation in the patient experience through the use of digital solutions, such as online medical care and mobile apps for patients. One of the challenges faced by Parkinson's patients is that hospital visits are a physical and financial burden due to lack of specialists and the fact that impaired mobility is the main symptom of the disease. Another clinical challenge is that it is difficult for patients to be fully aware of their own symptoms and to accurately communicate the frequency and severity of symptoms to their healthcare providers. The aim of this clinical study is to build an environment enabling Parkinson's disease patients who have difficulty visiting hospitals to sufficiently manage their disease from home using online care and medication guidance as well as Apple Watch and a specialized application. Takeda Pharmaceutical Company Limited aims to develop and provide highly innovative medicines while continuously improving patient outcomes by enabling patients to use these pharmaceutical products more effectively. In this context, it is working together with healthcare professionals and pharmacies to support the establishment of a sustainable healthcare delivery system that places patients at the center through the use of digital technology.

Monipad: An App to Tackle Parkinson's Disease

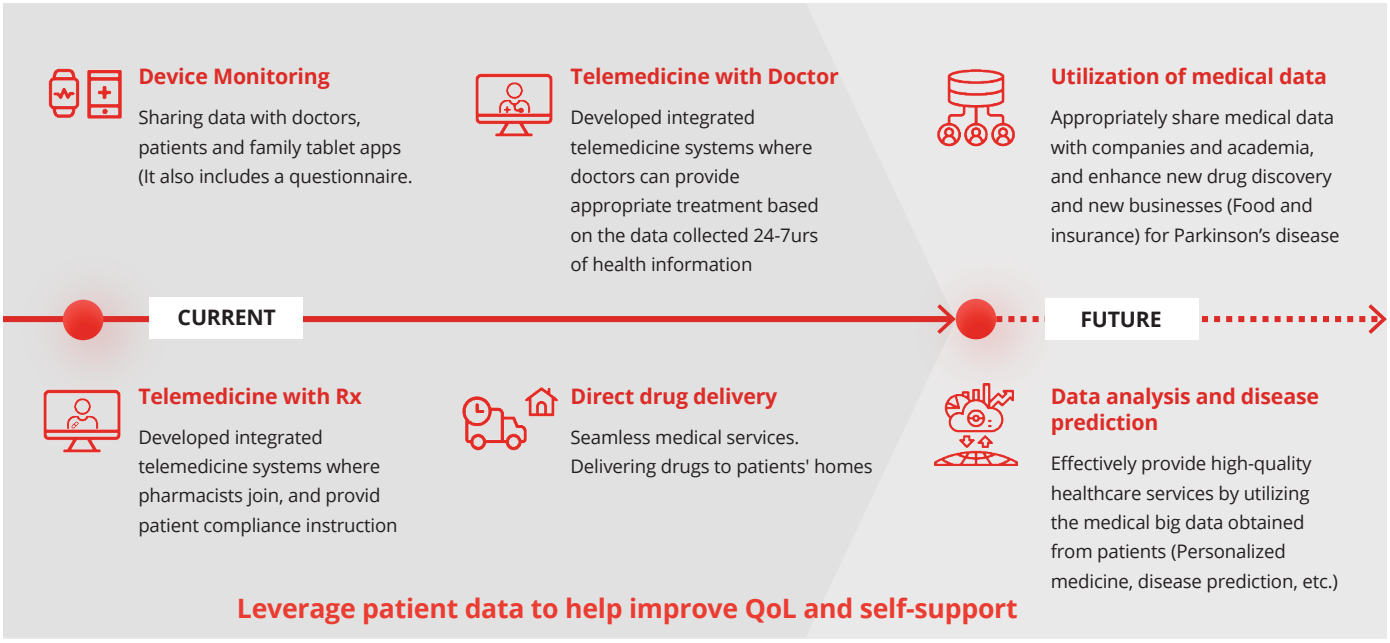
Automatic visualization* of Parkinson's symptoms using wearable devices and mobile apps.
Seamless telemedicine service from consultation to drug delivery at home.

*Tremors, dyskinesia, activity, etc.

Provided by Takeda Pharmaceutical Company Limited

According to project leader Reiko Onodera[*5], this project has reached 30 patients or participants as of the end of 2020 since patient entry started in July 2020. The shared vision of the future of healthcare using digital technology and the strong resonance with the concept of patient-centered healthcare were the success factors for achieving collaboration with diverse players such as hospitals and pharmacies. Onodera also commented, "Moving forward, we would like our goal to be to create something that both patients and doctors will want to use".
In the project, a demonstration device was created, and the design and data items were repeatedly revised through trials with patients and doctors. By incorporating the various perspectives of patients and doctors as well as the manufacturer's perspective, the project team hopes to achieve an even more user-friendly device.
Through this case study, we can see how a pharmaceutical company with a previously limited patient reach has been able to build a stronger relationship with patients through the realization of digital health approaches. From this, we can assume that as demand for platforms that store and link patient information increases, there will be even more need for action and collaboration between various players driven by the "patient-centric" concept.

CareForOne: Future vision



Provided by Takeda Pharmaceutical Company Limited

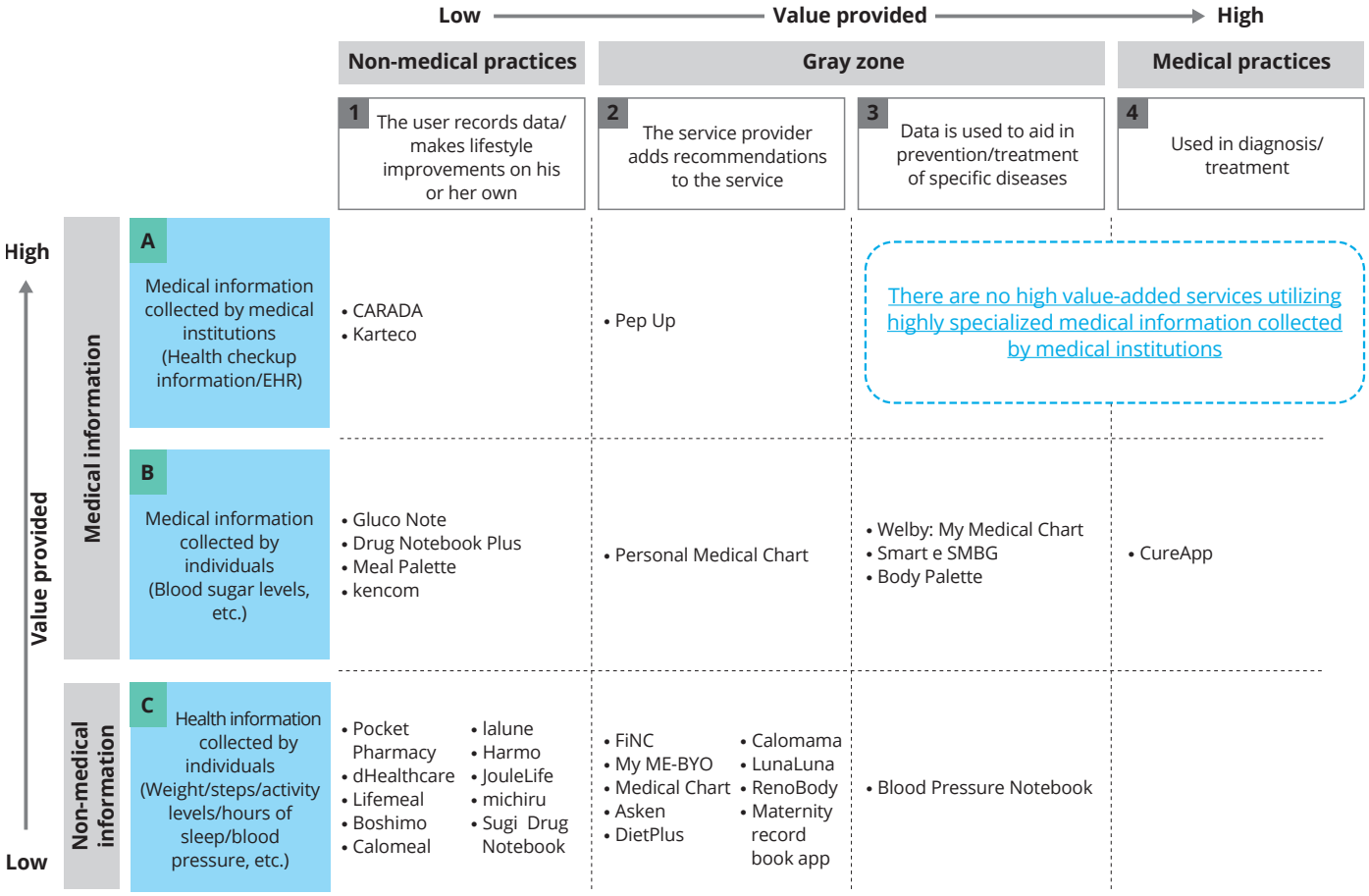
*5: Manager, Pipeline strategy, Insight, Planning and Development, Japan Pharma Business Unit, Takeda Pharmaceutical Company Limited

5. What should be done now in preparation for 2040?

5.1. Challenges toward creating a revolving eco-cycle in Japan

As we have already mentioned, the development of healthcare services in Japan that utilize digital technology is still limited compared to in Europe and the U.S., where such services have seen increasing penetration from early on. In particular, while a number of applications have emerged that collect personal health information (such as weight, steps, hours of sleep, diet, vital signs) and enable individuals to use this information to work toward improving their own health, such as through dieting, there are currently almost no high value-added services for the prevention and treatment of specific diseases that utilize the highly specialized medical information collected by medical institutions.

Figure 12: PHR[*6] service mapping in Japan



Source: Prepared by Deloitte Tohmatsu Consulting based on "Personal Health Care Service Market 2020" (Yano Research Institute Ltd.) and various public materials

*6: Personal Health Record (PHR) is the name of a mechanism for patients to use to collect their own medical/health information and store it in a centralized location. "PHR services" range from those that simply record and manage personal health and medical information; those that analyze the data and provide suggestions for health improvement; to those that process and provide the data for secondary use in research and development by research institutions and companies.

In order to create a revolving eco-cycle, the use of PHRs is essential - not only at the level of individual citizens, but also in medical institutions. This gap must be closed as soon as possible. In order to achieve this, governments or businesses must work together to break down some of the "barriers" listed below.

Figure 13: The 3 barriers against PHR penetration

Challenges to the spread of healthcare services		Description
Technology-related	Delays in establishing infrastructure	■ The large volumes of medical data needed to develop the predictive algorithms that are essential for providing useful suggestions have not been established *The status for providing integrated EHR (electronic health record) data is at the lowest level among OECD countries*1
	Limited investment in technologies	■ Investment in healthcare services using digital technologies such as advanced medical devices is extremely low compared to other countries, and the development of predictive algorithms is lagging
Business model (Service design)	Lack of evidence	■ There has been no accumulation of evidence related to promotion of health and disease prevention from preventive services (especially medium- to long-term evidence on the prevention of disease onset and control of social costs), and the companies and local governments which provide funding are hesitant to invest
	Low-level UI/UX	■ Incentives designed (including UI/UX) to encourage continued use of PHR services have not been implemented for preventive services as a whole
Laws and regulations related to services	Delays in establishing security	■ There are no regulations in place for personal information, security, data portability, etc.
	Lack of reliability for data	■ There are no regulations regarding the accuracy of data when obtaining individuals' health/medical information from devices, and it is unclear whether collected/stored PHR data can be used for medical purposes
	Lack of service quality assurance	■ Services that are very similar to medical practices are being provided with no regulations in place concerning the value provided or on service providers, or with unclear evidence behind said services

*1: From HCQI Survey of Electronic Health Record system development and Use, 2016, OECD, February 2017

(1) The barrier of technology

In Japan, there is still a lack of a large-scale medical database necessary for the development of predictive algorithms that can provide useful suggestions for the prevention and treatment of specific diseases. Given the scale and nature of the handled data, the government is expected to lead efforts to build such a database.

For activities related to this: it has already been decided that starting in FY2020, information on specific health examinations/infant health examinations will be viewable on the government-run information provision network system "Mynaportal", and drug information will be available from FY2021. In the future, the government plans to add other health checkup and medical checkup data to promote individual health and encourage behavioral changes.

On the other hand, this system is not intended for use in medical care, as it does not cover other health or medical information and can only be viewed by the individual (or his/her family) and not medical professionals or researchers.

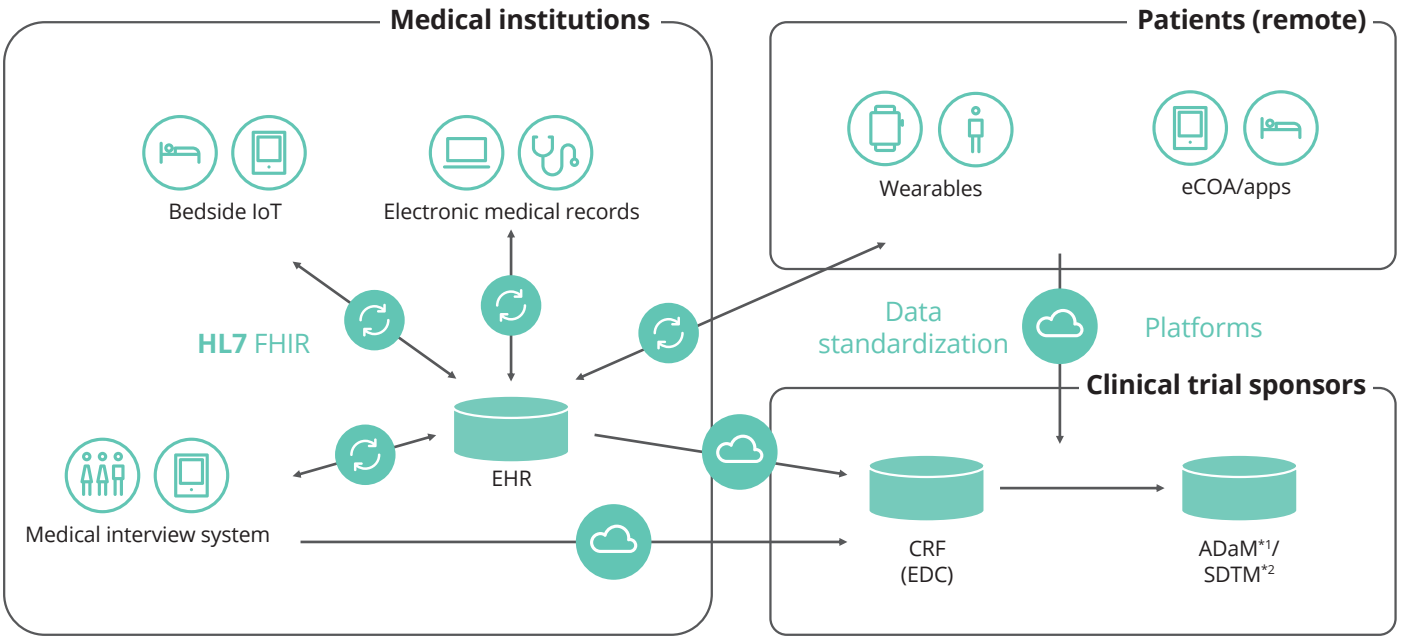
Along with the efforts described above, the "Headquarters for the Promotion of Data Health Reform", which is led by the Ministry of Health, Labour and Welfare, has established the "National Health and Medical Information Network" as a platform for providing optimal health management, medical treatment, and care in an individual and patient-oriented manner. The government is making efforts toward using this network to launch the "Health and Medical Record Sharing Service" in FY2020. This service would allow (with the patient's consent) the sharing of basic patient information and medical checkup information at the time of the patient's first visit to a medical facility. It is currently in the stage of prototype design/development and identifying/analyzing technical and operational issues as a demonstration experiment aimed toward full-scale operation.

As this demonstration experiment itself is scheduled to last until the end of FY2020, the roadmap for full-scale operation may have to be revised significantly. However, if all goes well in the future, it is highly likely that the release of the initial version will be possible in the next few years.

When sharing and integrating data stored on different platforms, it is necessary to unify the format used to link data across platforms. This is because if the platforms themselves have different formats, it would require building an interface to read the data each time they are linked, and this would be extremely inefficient. There are two main methods that could be used for format integration. The first is to develop a standardized API format for integrating medical information data and introduce this to each platform.

Currently, the format established by the MHLW for medical information exchange in Japan is based on international formats such as HL7[*7] version 2.5 and HL7 CDA release 2. However, approximately 16 years have passed since its design, and its implementation is complex; because of these reasons, it is no longer keeping pace with the times. Because of this, attention is now being drawn to the latest format, HL7 FHIR (Fast Healthcare Interoperability Resources), which started being introduced worldwide around 2015. HL7 FHIR employs the REST system, which is the system most common among web applications for PCs and smartphones. This makes it easy to obtain and share data through any kind of device. In addition, since the format's basic resources are open-source and available free of charge, with their specifications made public, it can be implemented more quickly and easily than conventional formats.

Figure 14: Inter-platform data linkage through HL7 FHIR



HL7 FHIR
Abbreviation for Fast, Healthcare, Interoperability, Resources

- Standardized format for data exchange (shift to open-source)
- **87%** of medical institutions use **EHR** products certified for receiving incentives by the U.S. government

*1: ADaM (Analysis Dataset Model) application statistical analysis data model
*2: SDTM (Study Data Tabulation Model) application clinical study data model
Source: UMIN Center documents
*7: Health Level Seven (HL7) is the name of the standard format for healthcare information exchanged determined by the U.S. standardization organization

As the penetration rate for this format in the U.S. has already exceeded 80% and major global IT vendors such as Apple and Google have already started to apply it, it is expected to spread across Japan in the future to become the standard format there, as well. However, in Japan, the penetration rate of electronic medical records is not high to begin with[*8], and strong government leadership will be needed to promote the introduction of HL7 FHIR, which will include the replacement of existing electronic medical record systems.
The second method for integrating formats when linking data is to build and implement an API integration infrastructure that absorbs the differences between multiple data platforms with different formats.
There are already many medical institutions and local governments using data platforms with different formats and replacing these with a new standardized format is a very difficult task and not very realistic. For example, an API integration infrastructure solution such as Salesforce's MuleSoft could be introduced as a connector to enable data-sharing between data platforms in a relatively simple manner. The active leveraging of such solutions is expected to increase in the current environment, where a high level of speed is required in launching new businesses.

Along with building databases, another important task will be to promote the development of AI engines equipped with algorithms that can provide useful insights for the prevention and treatment of various diseases. For this, the government is expected to actively invest its budget by strengthening R&D investment in AI vendors and device manufacturers that possess internationally competitive technologies, and by supporting blue-chip business operators through various venture support measures (Healthcare Innovation Hub, JHeC, etc.) [*9].

*8: According to the MHLW's "Trends in the spread of electronic medical record systems, etc.", the penetration rate among general clinics was only 41.6% as of 2017

*9: For example, in Israel, which is especially active in its support of venture companies, approximately 42% of start-ups (600 out of approximately 1,400 total) were companies developing advanced healthcare devices. Furthermore, according to a report by Israel NPO Start-up Nation Central, 85% of funds invested in digital healthcare in 2018 were made toward AI healthcare companies, and it is assumed that emphasis is being placed on the development of solutions leveraging AI. These bold investment policies are predicted to become the source of internationally competitive solutions (Reference article: https://www.businessinsider.com/israel-digital-health-hotspot-2019-4)

(2) The barrier of evidence/service design

There is a tendency for users (e.g., medical professionals, patients) to have stronger demands for evidence regarding the efficacy and safety of services as the areas handled by these services become more specialized. This is true not only when trying to obtain certification as a medical application, but also in cases where local governments and private insurance companies introduce new services. Even if a prediction algorithm based on a large amount of data is developed, close verification through demonstration experiments and other methods must be performed to test whether it is actually effective in prevention and treatment, and whether users will accept and fully utilize the new service. As in the case study for Takeda Pharmaceutical Company Limited introduced in Section 4, it is predicted that there will be a trend toward active collaboration among players in industry, government, and academia (including companies, local governments, and medical institutions) which results in an increasing number of services gaining penetration through demonstration experiments. Additionally, service design that takes the lifestyles and preferences of users into consideration and the development of user-friendly and sophisticated UI/UX will also be important elements for having users continue to use the service.

Figure 15: Problem-solving strategies

Challenges to the spread of healthcare services		Strategies for dealing with challenges	Leader of solutions
Technology-related	Delays in establishing infrastructure	■ Prepare the learning data (database integrating EHR, PHR, etc.) necessary to present medically useful suggestions	National government
	Limited investment in technologies	■ Invest in research and development for AI vendors/device manufacturers with internationally competitive technologies ■ Support blue-chip companies through venture assistance (Healthcare Innovation Hub, JHeC, etc.)	National government
Business model (Service design)	Lack of evidence	■ Establish empirical research projects for using PHR data covering diseases to accumulate/construct evidence for disease prevention	National government/ companies
	Low-level UI/UX	■ Conduct marketing (large-scale consumer) research to ensure users continue to use the service, and accelerate research and development using leading overseas services as benchmarks ■ Provide support (such as through subsidies) for market penetration/expansion of services for which quality (UI/UX, data quality, etc.) has been ensured	National government/ companies
Laws and regulations related to services	Delays in establishing security	■ Establish security criteria/guidelines for each type of data provided	National government
	Lack of reliability for data	■ Evaluate device requirements needed for enabling medical use of collected/stored PHR data and establish empirical research projects at medical treatment sites	National government
	Lack of service quality assurance	■ Establish empirical research projects for investigating the requirements/certification criteria to be met by service providers	National government

(3) The barrier of laws and regulations

With the development and spread of digital health, various laws and regulations concerning medical information (including the handling of personal information, security, and data management) are being developed at a rapid pace from the perspectives of both protecting individual research interests and promoting medical research and development/improving the patient experience.

First, in May 2018, the Act on Anonymized Medical Data That Are Meant to Contribute to Research and Development in the Medical Field (commonly known as the Next-Generation Medical Infrastructure Act) came into effect. This law establishes regulations on the secondary use of medical data held by medical institutions, insurers, local governments, and so on. Under the law, those who meet certain standards, such as ensuring high information security and possessing sufficient anonymizing technology, and who can appropriately and reliably perform anonymization for the management and utilization of medical information, are certified by the government as "certified producer of anonymized medical data". The law stipulates that medical institutions can provide medical information to these certified entities if the individual does not refuse to allow this provision. After anonymizing the data, certified producers will be able to utilize the data for various studies and research in the medical field [*10]. On the other hand, there are still no applicable regulations or guidelines in place regarding rules for the services of PHR business operators who provide users with insights obtained from medical information. Furthermore, when PHR services provide suggestions and recommendations for the prevention and treatment of diseases, the criteria for determining whether or not these are medical practices subject to regulation under the PMD Act have not yet been developed, so there is currently a risk of providing services that are very similar to medical practices without insufficient evidence behind them. It is hoped that these laws and regulations will also be considered in the government's investigation committees and similar for the topics mentioned above, and that they will be put in place as soon as possible.

*10: Refer to the following for system details: https://www.mhlw.go.jp/content/10601000/000406831.pdf. As of December 2020, five organizations have been recognized by the government as certified entities (certified producers of anonymized medical data: general incorporated association Life Data Initiative (LDI), general incorporated foundation Japan Medical Association Medical Information Management Organization (J-MIMO). Enterprises certified for entrustment with handling medical and related information and anonymized medical data: NTT DATA Corporation (NTT DATA), ICI Inc., NS Solutions Corporation (NSSOL)). On December 14, 2020, Pfizer Japan Inc. announced that it signed a contract with LDI and NTT DATA based on this act regarding the provision of anonymized medical data in order to conduct research utilizing medical big data. This initiative is the first of its kind in Japan, and it is anticipated that it will stimulate efforts by each of the companies in the future.

5.2. What should companies do now?

Although the barriers mentioned above are currently obstacles for creating a revolving eco-cycle, they are expected to be gradually eliminated through the efforts of various players in industry, government, and academia, including the national government, local governments, and businesses. Once this has happened, the revolving eco-cycle will begin to turn at high speed, and the healthcare market will expand explosively with the continued entry of new players and the introduction of a variety of services. This will result in achieving the evolution toward the 2040 "vision of the future".

What should companies do now in preparation for this change? We believe that the answer is that they should clarify for themselves what they are now, and boldly define what they want to become in 2040 and beyond. Regardless of whether or not the company currently participates in healthcare business, it should identify its own strengths, such as its capabilities/differentiators, and select business models/added value based on the area it will be responsible for from the archetypes forming the 2040 healthcare market, and how it will carry out this responsibility. After doing so, it will need to design a roadmap for investments and establishing partnerships toward achieving this transformation, and swiftly begin its execution. By moving as swiftly as possible to envision the ideal form for 2040, investing in transformation, and involving other players to build a platform for services, companies will be able to easily acquire subsequent competitors and, as a result, dramatically increase their chances of winning in the market.

Figure 16: 3 steps toward transformation

1

Identify winning factors in current business

- What factors succeed in differentiating current business?
- Which capabilities/assets/ differentiators can aid winning even in the increasingly uncertain future of the market?

2

Select business models and added value for winning in 2040

- What kinds of revenue opportunities are there?
- What is the company's ambition? How does it want to impact the world?
- When combining successful business types, which combinations are the clearest, most influential, and enable the most differentiation?

3

Create roadmaps for business transformation

- Where will the company invest? What will the company build on its own?
- In what areas will the company utilize cooperation from external players?
- What will the company acquire or integrate in cases where it cannot easily build or work together with its partners for what it needs?
- When and how will the company transform its talent and technology?

Approaches that evaluate the company's business from a big-picture perspective are considered ideal

6. Epilogue

■ For the coming year of 2040, we predict a “vision of the future” for the entire world, and particularly for advanced nations in which the super-aging of the population is becoming more serious. In this vision of the future, citizens will be empowered by the latest digital health technology to make comprehensive and autonomous decisions toward the pursuit of their own well-being based on all data relevant to them, as well as insights derived from this data.

■ In order to achieve this vision of the future, it will be necessary to promote the creation of a massive platform for collecting/analyzing all kinds of data concerning citizens, as well as to encourage the changes in attitude/behavior needed for citizens to autonomously and comprehensively manage their own well-being using data and insights based on data. This trend is expected to become active over the medium- to long-term span of the next five to ten years, and the changes are expected to be driven by existing major players in healthcare as a “revolving eco-cycle”.

■ As we have explained using several case studies, this revolving eco-cycle has already been set into motion. With the advent of a future in which any company, not just existing healthcare players, can become a player in healthcare, we believe that it is important to make bold definitions right now; existing players should define how they will rethink their strategies, and new players, what they will use as drivers to enable their successful entry into the market.

■ Furthermore, as we examined in Section 2, individual patients will be the starting point for the healthcare vision of the future that achieves this digital transformation. In other words, broad and deep understanding and sharing of information on patients is essential in enabling these various players to form organic partnerships and actively and continuously provide valuable services.

■ As was also mentioned in the case study of Takeda Pharmaceutical Company Limited, initiatives where healthcare providers use digital technology to connect with patients and actively provide service support, and where patients also participate proactively in treatment, have already begun in Japan. Salesforce calls such initiatives Co-Active patient engagement.

■ Salesforce has been the leading CRM company for the past 20 years supporting customer-driven digital transformation in various industries, including the healthcare industry. It will continue to support Co-Active patient engagement initiatives during this major shift in the industry from traditional passive, one-shot healthcare to active and continuous healthcare involving many various players.

■ Deloitte Tohmatsu Consulting (DTC) has specialized teams in the life science/healthcare industries that are among the largest both globally and in Japan, and provides end-to-end support ranging from strategy development to execution support. Particularly in recent years, it has worked to promote digitalization and digital-based transformation by focusing on developing and providing "ConvergeHEALTH™", which is a set of industry-specific solutions including those that were designed and developed exclusively by Deloitte Tohmatsu Consulting. In the past few years, it has been aiming to enhance value provided to patients through supporting the introduction/ expansion of Health Cloud-based solution package "ConvergeHEALTH™ Connect for Life Sciences", mainly for businesses in Europe and the U.S.

■ By leveraging this set of solutions, experience with various projects and diverse professional knowledge, as well as Deloitte's global network, DTC contributes to achieving the healthcare vision of the future and solving social issues through fostering an environment for realizing true "patient centricity".

■ Finally, the future of healthcare will be created by each and every one of you, as readers, citizens, and sometimes as patients. We strongly hope that this document will provide useful suggestions for realizing the "future vision" of healthcare.

"Data-driven Life Brilliance: Using data to create lives that shine with vitality".
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