Monitor
Deloitte.

Potential and issues for medical MaaS as a core for regional development

1. Overview

It is a well-known fact that our country is currently experiencing a birthrate decline and aging population at a speed unparalleled in the rest of the world. About 80% of the elderly over 75 years of age suffer from multiple chronic diseases[1] and require regular visits to the hospital. However, there continues to be a rapid decline in accessibility to the appropriate medical facilities due to elderly drivers surrendering their driver's licenses and the retirement of public transportation services as a result of population decline, especially in rural areas. In addition to worsening the health status of the elderly and increasing the burden of medical and nursing care on local governments, this decline in elderly's access to medical care will also lead to stagnation of economic activities (including a decline in tax revenues) due to less opportunities for the elderly to go outside. This makes it a social issue that is particularly important not to overlook.

Medical MaaS is gaining attention as an initiative to physically improve patient accessibility to medical care. The following three patterns of medical MaaS exist depending on the mobile entities (doctors/patients/medical facilities). The pattern should be selected according to the physical characteristics of the area and

how difficult it is for patients to get around.

1. “Home medical support type” medical MaaS
   Medical MaaS that aims to improve medical accessibility by having doctors use mobility services to travel to patients’ homes
2. “Hospital visit support type” medical MaaS
   Medical MaaS that aims to improve medical accessibility by having patients use mobility services to travel to the optimal medical facilities
3. “Intermediate type” medical MaaS
   Medical MaaS that aims to improve medical accessibility by using mobility services to transport testing/treatment equipment to locations close to patients

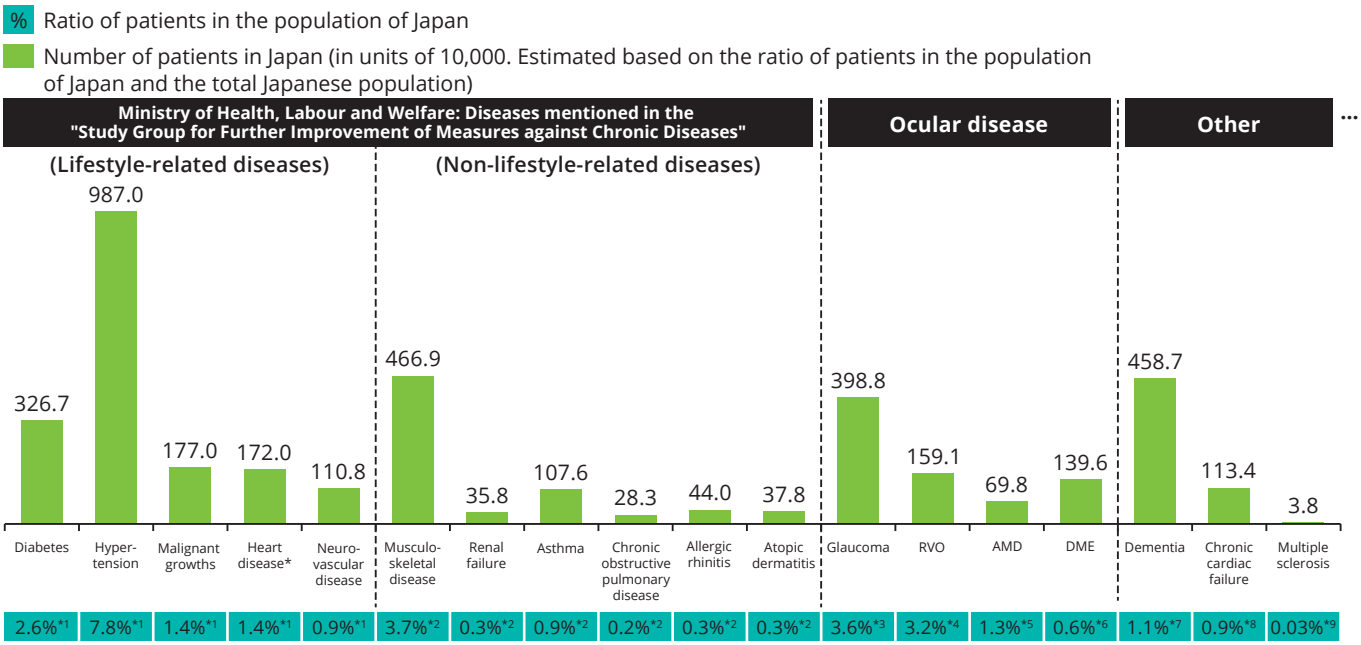
For example, the "home medical support type" would be suitable for a patient in the terminal stage of cancer who has difficulty getting around, while the "intermediate type" would be suitable for a patient in relatively good health who is able to get around and who lives in a medically underserved area, i.e., a large area with only one medical facility. In respect to simply providing medical care to patients, any of those two types of medical MaaS above could be sufficient. However, when we focused on elderly people's behavioral pattern of running all their daily errands in conjunction with hospital visits, we saw that if "hospital visit support type" medical MaaS can be positioned as a method to support elderly people in their outings, it could be a method that improves not only access to medical care but also overall quality of life, and ultimately revitalize local economies. In addition, the data obtained through the services will include not only medical data but also behavioral data before and after hospital visits or purchase data, making it possible to analyze the behavior of the elderly suffering from chronic diseases with greater precision. For the government in particular, "hospital visit support type" medical MaaS can be expected to play a central role in urban OS. This is because, in additional to its potential for use in medical risk stratification of residents and planning/implementing effective intervention measures to prevent chronic diseases such as diabetes from becoming severe, it can also be used to accurately identify and provide support for elderly people with mobility issues in the event of a disaster.

In this paper, we will use the overview and results of the "hospital visit support type" medical MaaS demonstration study that we have implemented in cooperation with Chiba City and private companies as a basis for considering the potential for regional development held by "hospital visit support type" medical MaaS, as well as the issues that need to be addressed to achieve this.

2. Introduction: Issues in medical access for the elderly

In Japan, it is estimated that there are currently more than 38 million patients with chronic diseases such as hypertension and diabetes who require regular hospital visits. A major challenge concerning these chronic diseases is the high treatment discontinuation rate (for example, the treatment discontinuation rate for diabetic patients is reported to be 44%[2]).
Not only does discontinuation of treatment for chronic diseases increase individuals' risk of developing severe disease or complications – it is also a factor that can have a negative impact on many diverse stakeholders, such as by leading to higher social security costs and future nursing care burden for local governments, and lower labor productivity due to absenteeism and presenteeism among the working-age population for companies.
Reasons for high treatment discontinuation rates have been reported in the results from various past studies, and we believe that these can be summarized as the influence of "three barriers" (knowledge, physical, and psychological) on the magnitude of the burden of hospital visits. A "knowledge barrier" is caused by a patient's lack of understanding of his or her disease, such as a patient mistakenly judging based on his or her subjective symptoms that treatment is not necessary, or a patient deciding on his or her own to discontinue treatment because he or she believes that a remission of the disease has occurred due to a slight improvement in symptoms. A "physical barrier" refers to reduced physical access to medical care due to a decline in physical function from frailty or similar, or insufficient means of transportation. For example, we might imagine a situation where a chronically ill patient who routinely visits the hospital by bus or train is forced to cancel his or her appointment because it is too hard to walk under the hot summer sun or in heavy rain. The

Figure 2-1: Patients with chronic diseases requiring regular hospital visits



*1: 2017 figures, *2: 2005 figures, *3: 2012 figure, *4: 2019 figure, *5: 2010 figure, *6: 2009 figure, *7: 2012 figure, *8: 2002 figure, *9: 2017 figure
Source: Various public information

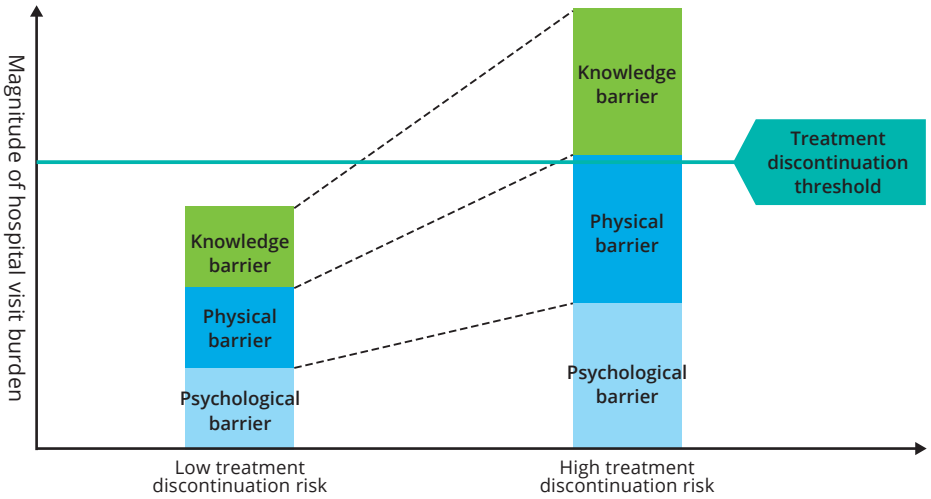
impact is particularly significant for elderly living in rural areas who do not have a driver's license. In particular, with the backdrop of recent social issues, the number of elderly people who have surrendered their driver's license has rapidly increased to around 500,000 people per year. Since elderly people who have surrendered their driver's license are 20 to 30% less likely to go on outings than license holders[3], there is an urgent need to ensure physical access to medical care for the elderly in preparation for the large number of elderly who will surrender their driver's license in the future.

Finally, a "psychological barrier" refers to situations where patients stop visiting the hospital due to psychological factors such as fear of highly invasive testing and treatment, anxiety about long-term treatment where the future economic burden is unclear, or simply laziness about taking the trouble to go to the hospital. This includes patients who are so busy with other issues in their lives that they are unable to prioritize their hospital visits. For example, in our past interviews, we identified certain patients who were so busy with their responsibilities in other people's daily lives, such as picking up and dropping off of family members, that they were forced to put off their own hospital visits and eventually dropped out of treatment. We believe that discontinuation of treatment occurs when the total magnitude of the burden of hospital visits exceeds a certain threshold for the patient due to the gradual accumulation of factors in these three barriers.

There have been several reports on corporate initiatives for addressing the "knowledge barrier" and "psychological barrier" related to discontinuation of treatment for chronic diseases. For example, various pharmaceutical companies operate patient awareness websites for various diseases to make repeated appeals on the importance of early detection and continued treatment of chronic diseases to the public. There are also activities that aim to break down the "psychological barrier" associated with treatment through communication between patients, such as “Peer ring”, a community for breast cancer patients, and “tomosnote”, a community site for people who have experienced cancer. However, the "physical barrier" is beyond the scope of a single company's efforts and is currently left largely untouched.

Because of this, in this paper we focus on and consider the causes behind physical decline in medical care accessibility, which has a particularly large influence on the "physical barrier". The main physical factors in reduced access to medical care stem from issues in medical and transportation infrastructure development. From a medical perspective, a major factor is the lack of advancement in medical field-related DX investment (such as telemedicine and remote patient monitoring) resulting from medical facilities' chronic loss-making status (-21% annual profit/loss differential rate in public hospitals[4]). Because of this, medical facilities have been unable to shift from a medical care delivery system centered on face-to-face medical care during the COVID-19 pandemic. The aging trend among physicians has also led to reduced capacity for supplying face-to-face medical treatment. In the COVID-19 pandemic, this infrastructure deficiency is evidenced by

Figure 2-2: Visual representation of the mechanism behind patient discontinuation of hospital visits



the fact that while there was a rapid increase in the percentage of patients using medical care and wearable devices around the globe, Japan remained significantly behind in contrast[5]. Another factor is the continued increase in physical distance between patients and hospitals due to consolidation of hospital functions and the closing of clinics due to a shortage of physicians in rural areas.

From a transportation infrastructure perspective, a major factor in the decline of physical access is the collapse of transportation infrastructure in rural areas. This is increasingly cutting off the elderly's access to various urban infrastructures including medical facilities[6]. When we examine regional transportation operators, we can see that bus operators have been loss-making, and it seems that the standard has become for services to run based on compensation by local governments. As for taxi operators, they also had low operating profit margins even before the COVID-19 pandemic (some operators had an operating profit margin of 1%), and an increasing number of taxi operators are operating at a loss, which is causing them to withdraw from the market one after another. This combination of medical care and transportation issues has resulted in creating the serious issue of a "North/South Divide" for medical care, i.e., difficulty in accessing medical resources in rural areas and uneven distribution of the areas where advanced medical care can be provided.

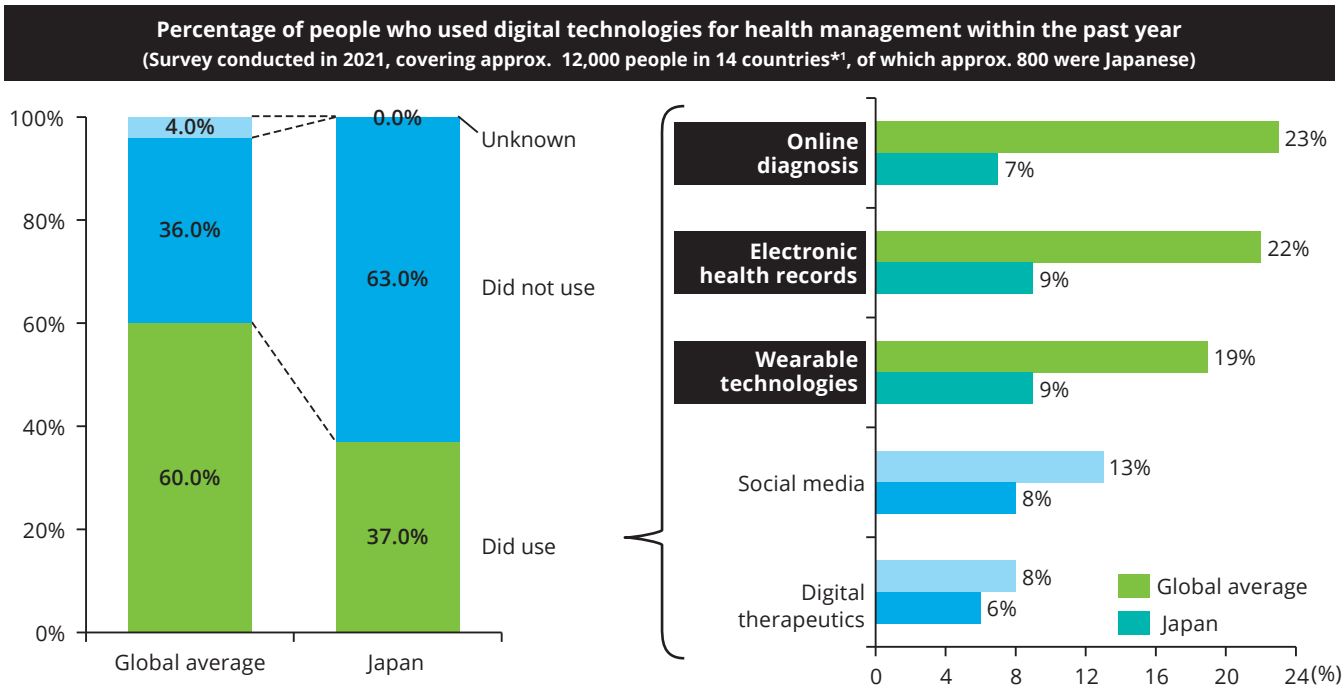
The decline in patients' access to medical care is expected to have a serious impact on local governments by creating a negative spiral where discontinuation of treatment causes diseases to become worse, resulting in an increase in medical costs and people who are mobility-impaired, as well as a decline in the local economy due to a further decline in the percentage of people going out. Therefore, it is an urgent issue that needs to be addressed.

However, from the following perspectives, we believe that it is difficult for private companies or local governments alone to tackle the above issues related to urban infrastructure, such as medical care and transportation infrastructure.

1. Size of investment burden for infrastructure development

   Developing urban infrastructure that covers an entire city, such as for medical care and transportation, requires a huge initial investment. In addition, due to the nature of infrastructure, once a service is started, it must continue to operate stably over a long period of time, so one must be prepared to commit to a

Figure 2-3: Trends for medical use of digital technologies (Japan/global)



Source: Prepared by Deloitte Tohmatsu Consulting based on information from The Nikkei: BP Beyond Health (February 3, 2022)

*1: Countries targeted in the survey were the U.S., Ireland, the U.K., Italy, Spain, Germany, France, Norway, Finland, Australia, India, Singapore, China, and Japan

long-term investment. As mentioned earlier, medical facilities and transportation operators are chronically loss-making and do not have the power to withstand these huge and long-term investments. On the government side, in addition to the trend of shrinking budgets due to depopulation in rural areas, the "single fiscal year principle" makes long-term budgeting difficult, and the high degree of difficulty in considering debt burdens across fiscal years is a hurdle to investment. Rigid budgeting and sectionalism also make it difficult for flexible budget spending to solve cross-sectoral issues such as medical care and transportation, which is another factor preventing the contribution of public funds.

2. Free rider problem for services

By nature, urban infrastructure services are not limited to a single beneficiary. When considering the example of medical MaaS, we can see that there are multiple stakeholders. Listing out the benefits for each stakeholder shows that transportation operators, for example, can expect an increase in revenue due to an increase in the number of users and reduced costs from securing long-term reservations to level out operational peaks and valleys. Medical facilities can also expect an increase in revenue per patient due to an increase in the patient retention rate, and local governments can expect an increase in tax revenues from a more attractive city causing an increase in residents, and a decrease in long-term medical expenses and nursing care costs from preventing residents from developing severe chronic diseases. Thus, it is unacceptable from an equity perspective to have a free rider problem arise where various stakeholders benefit while the investment burden is borne solely by transportation operators or medical institutions. It is also difficult for local governments to receive permission from residents for large and long-term investments made to increase revenues for private operators in a specific industry.

3. Addressing diverse needs from a mobility perspective

Once users have secured transportation to medical facilities, it can be assumed that various user needs from a mobility perspective will become apparent apart from those for hospital visits. For example, our

Christopher Alexander, an architect who has been the focus of attention in recent years for his work on pattern language and agile development, explained that "a city is not a tree"[7]. From his practical design experience and fieldwork, he points out that cities unfortunately cannot be semilattice structures. For example, sets 1 through 6 which make up urban issues are broken down into 1,2 and 3, 4, 5, 6. 1, 2 is further broken down into 1 and 2, and 3, 4, 5, 6 is broken down into 3, 4, 5, and 5 and 6. In reality, however, this kind of tree structure is unlikely, and there are issues for the sets of 123, 234, and 345, and 2 and 3 should be interrelated. Instead of proceeding in a waterfall fashion from whole to part and top to bottom, there is an interdependence between whole and part, up and down, left and right, and he states that it is necessary to accommodate this when addressing the issues. Alexander discusses only the components of the city, i.e., automobiles, bricks, gardens, houses, and the blank spaces of the city, but he explains that a city has complexity, overlap, and ambiguity, and that it is better when it has a semilattice structure rather than a tree structure. However, the most important thing is simply that people are unable to plan or think without a tree structure, and semilattice structural issues are created through activities born from tree structures.

In other words, although they are not urban planning issues, we may also consider the issues facing cities discussed in this paper (energy, mobility, education, issues facing the elderly, medical care, privacy, etc.) as issues that exist outside of the tree structure. Based on this idea, he established a pattern language by preparing numerous patterns that would become necessary for urban design, and then preparing them as a language.

There is no single resource, or strategy which serves as a pattern for solving the multilayered problems that exist in cities. Rather, these must be solved by preparing and combining a broad array of solutions. If we consider this as an analogy to medical MaaS, we can see that a medical MaaS service must be built as a single package including various functions.

past studies have shown that rural residents run a variety of errands, such as shopping, in conjunction with their hospital visits, and that there is demand for stops made at other facilities on the way home from the hospital.

It is difficult for transportation operators and medical facilities alone to commit an "airspace violation" when a simple need for going a medical facility expands to a complex need such as transportation at a good value, transportation to another facility, or home delivery of medicine.

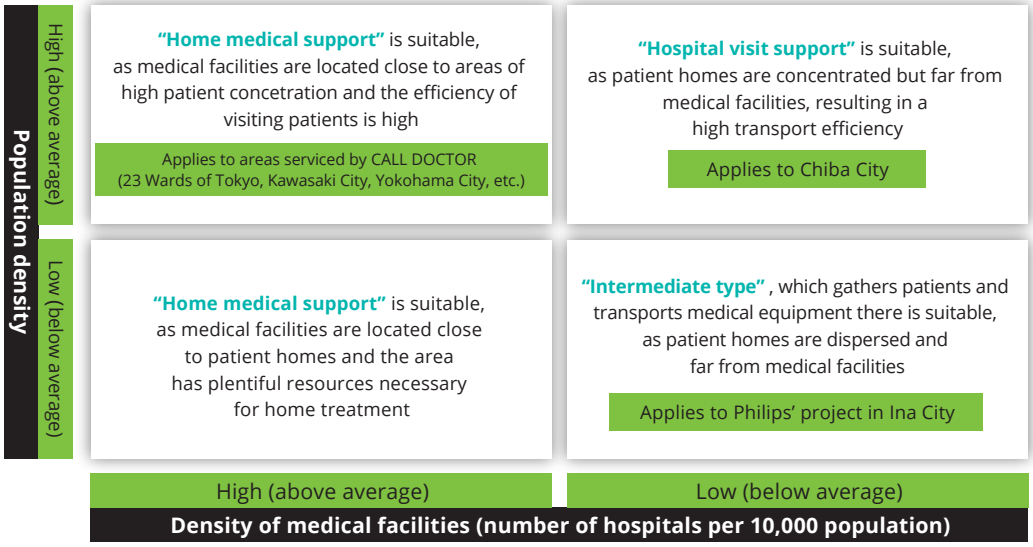
In order to solve the above issues, a medical MaaS consortium should be established between all beneficiaries, including transportation services, medical facilities, and local governments, to share the investment burden and business operation responsibilities while aiming for a business model that achieves mutual benefit and mutual prosperity (see Section 5 for details).

3. Medical MaaS concepts expected to solve issues

Once again, as a method of physically resolving issues of access to medical care for the elderly, it is possible to divide current medical MaaS services into the following three patterns by changing the mobile entities (doctors/patients/medical facilities).

1. Doctors are mobile: "Home medical support type" medical MaaS
   This is a form of Medical MaaS that aims to improve medical accessibility by having doctors use mobility services such as taxis to travel to patients' homes. This is a service that rapidly gained particular attention in the COVID-19 pandemic. In Japan, there is a house call service provided by the HOME DOCTOR company.
2. Patients are mobile: "Hospital visit support type" medical MaaS
   This is a form of Medical MaaS that aims to improve medical accessibility by having patients use mobility services such as taxis to travel to optimal medical facilities at the optimum timing. Reserving a vehicle dispatch to a medical facility is no different from making a simple cab reservation. The real significance is that making a vehicle dispatch reservation at the optimum time in conjunction with a medical appointment allows the patient to secure a vehicle dispatch regardless of the weather or other environmental factors on the day of the appointment, and lets the patient receive medical treatment without having to wait. While it has not yet been launched in Japan, Uber has already launched Uber Health in the U.S. This service links medical appointment reservations to Uber vehicle dispatch reservations, and has shown significant results in reducing medical losses such as patient cancellations of medical appointments[8].
3. Medical facilities are mobile: "Intermediate type" medical MaaS
   This is a form of Medical MaaS that is an intermediate form between 1. and 2., which aims to improve medical accessibility by using mobility services to transport testing/treatment equipment to locations close to patients. It allows patients access to necessary medical care through having them travel from home to visit locations with laboratory equipment and other equipment brought into closer proximity than a hospital. However, since it is not possible to transport advanced medical equipment, there are limits to the medical services that can be provided. In Japan, Philips is conducting a demonstration project in Ina City.

Figure 3-1: Medical MaaS property classification



Application scope for each medical MaaS pattern

The applicability of each Medical MaaS pattern can be broadly classified as follows according to the density of medical facilities in the area (number of medical facilities per 10,000 population) and the degree of difficulty for patient mobility.

For example, "home support type" medical MaaS, in which a nearby primary care doctor makes house calls to provide treatment, is suitable for patients living in areas with high population density and high density of medical facilities (upper left quadrant) due to the short distance between medical facilities and patients and the high mobility service efficiency rate. CALL DOCTOR is an actual company that targets such areas. CALL DOCTOR targets areas with high population density and medical facility density, such as the 23 wards of Tokyo and the cities of Kawasaki and Yokohama, and has expanded its services by successfully capturing the demand for home medical visits resulting from the COVID-19 pandemic.

On the other hand, for patients living in areas where both population density and medical facility density are low (lower right quadrant), e.g., in mountainous, underpopulated areas where there are not enough taxis, "intermediate type" medical MaaS is suitable for providing treatment by transporting items such as telemedicine systems or treatment equipment, which enables administration of medicine via IV/injection at a location close to the patient. This applies to the services provided by Philips in Ina City. In Ina City, Philips operates a service in which a dedicated vehicle is equipped with a telemedicine system, ECG monitor, and other testing equipment so that elderly people living in mountainous areas are provided appropriate access to a core hospital through remote medical care.

“Hospital visit support type" medical MaaS can be considered a suitable type in rural urban areas with high population density but relatively low medical facility density (upper right quadrant) for patients with a relatively high degree of mobility difficulty (e.g., elderly patients suffering from ocular, cardiac, and chronic diseases), perinatal women, etc.

As discussed in the previous section, elderly patients have a high incidence of chronic disease, and their frequency of outings is reported to be greatly reduced due to declining physical functions[9]. When elderly patients go out less frequently, it not only leads to worsening of chronic diseases due to treatment discontinuation, but also increases the risk of developing various diseases such as dementia and frailty as physical and cognitive functions decline. In fact, various local governments have reported cases of decline in cognitive function and ADL as a result of reduced opportunities for the elderly to go outside due to the COVID-19 pandemic starting from 2020[10]. Dementia and frailty increase not only medical costs but also the nursing care burden, and can be a factor behind the rapid worsening of medical and nursing care burdens for rural areas. Because of this, it is also extremely important from the perspective of healthcare financing to create an environment in which elderly patients can access medical facilities and continue treatment, especially in rural areas with poor access to medical care.

However, as mentioned earlier, while Uber Health has shown to be highly effective in improving the efficiency of medical care with its "hospital visit support type" medical MaaS overseas, an adequate proof-of-concept has not been reported in Japan, and unless the situation changes, the service will not reach the launch stage.

In light of the above, along with recognizing the need to launch a "hospital visit support type" medical MaaS service, we focused our investigation on targeting elderly patients with chronic diseases who live in areas with high population density but a small number of medical facilities and who are a significant physical distance from medical facilities. In addition, when we focus on the behavioral pattern for elderly people in rural areas to do all their daily errands in conjunction with hospital visits, we assume that if "hospital visit support type" medical MaaS could be positioned as a means of supporting not only hospital visits but also outings, it could be a means of improving overall quality of life as well as access to medical care, and could ultimately revitalize the local economy.

The first key aspect of "hospital visit support type" medical MaaS is ensuring that vehicles are dispatched in time for the patient's medical appointment on the day the patient is scheduled to be seen. Consequently, it becomes necessary to establish long-term vehicle dispatch reservations linked to medical appointments, which is normally difficult. There is another goal in linking medical appointments with vehicle dispatch reservations; in a general hospital with multiple medical departments, it is very likely for there to be patients who live close to each other and have medical appointments in different departments at the same time on the same day (e.g., Mr. A who visits the internal medicine department at 8:00 a.m. on X/X and Mr. B who visits the orthopedic department at the same time). If such patients' routes could be organized and carpooled efficiently, it would increase the efficiency of transportation and reduce the per-patient cost, even if coordination with taxi services was involved.

In order to make the system a means to support patient outings, it will be necessary to realize a flexible route

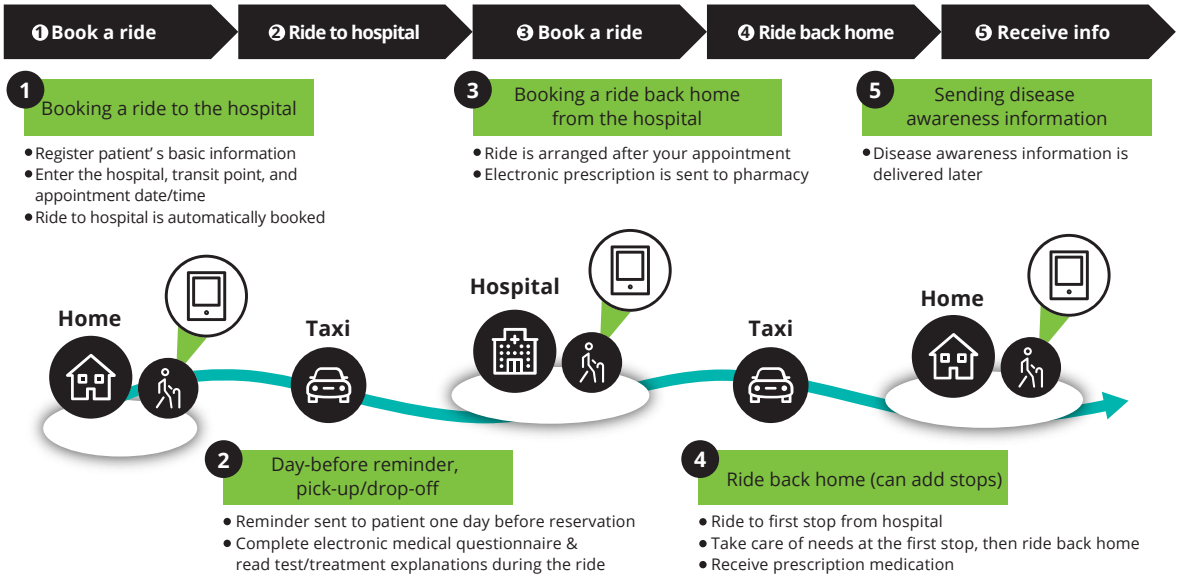
design that allows users to return home after a medical appointment via stops that they have registered in advance. In addition, enroute vehicles can be used as spaces for relaying information, such as performing medical questionnaires and providing explanations about the day's tests and treatments, which will allow for improved efficiency of medical care.

Basic concept for "hospital visit support type" medical MaaS

Based on the above, we have designed the basic concept for "hospital visit support type" medical MaaS as seen in Figure 3-2.

1. Vehicle dispatch reservations
   The shortest route from a patient's home to the hospital is created when he or she enters the hospital name, transit point, and scheduled date and time. The time required for travel is also automatically calculated based on past statistical traffic information, and the vehicle dispatch date and time are set so that the patient can be seen without having to wait. Since this concept is expected to have a customer referral effect, a list of partner companies (supermarkets, drugstores, etc.) paying sponsorship fees will be presented at transit points, which patients will be able to select and set.
2. Pick-up and drop-off (outbound)
   In order to ensure that patients do not forget their medical appointments, patients receive a reminder notification the day before, and information about the tests and treatments to be performed that day is sent to the patient's device so that it can be viewed in the vehicle on the way to the clinic. The medical questionnaire for the appointment day is also sent to the patient's device so that it can be answered in the vehicle beforehand.
3. Return trip reservations
   After the examination, patients can activate the app while waiting to pay to arrange for their return trip. In addition, patients who receive prescriptions for medication can relay their electronic prescriptions to their local pharmacy via their device in order to receive their medications without having to wait.
4. Return trip pick-up and drop-off
   Patients receive transportation to and from their pre-registered transit point. Coupons that can be redeemed at the transit point are sent by sponsoring companies to patient devices in order to encourage patient economic activity. In cases where the stopover is at a dispensing pharmacy, the patient promptly receives his or her prescription medication prepared in accordance with the prescription sent in advance.

Figure 3-2: Basic concept for "hospital visit support type" medical MaaS



In cases where the stopover is a location where the user intends to stay for a longer period of time, such as a supermarket, he or she will make a reservation for the dispatch of another vehicle at the transit point.

5. Delivery of medical information
   After the patient returns home, information on how to spend the time until the next appointment and information educating the patient on the importance of continuing treatment will be sent to the patient's device in order to encourage him or her to continue treatment.

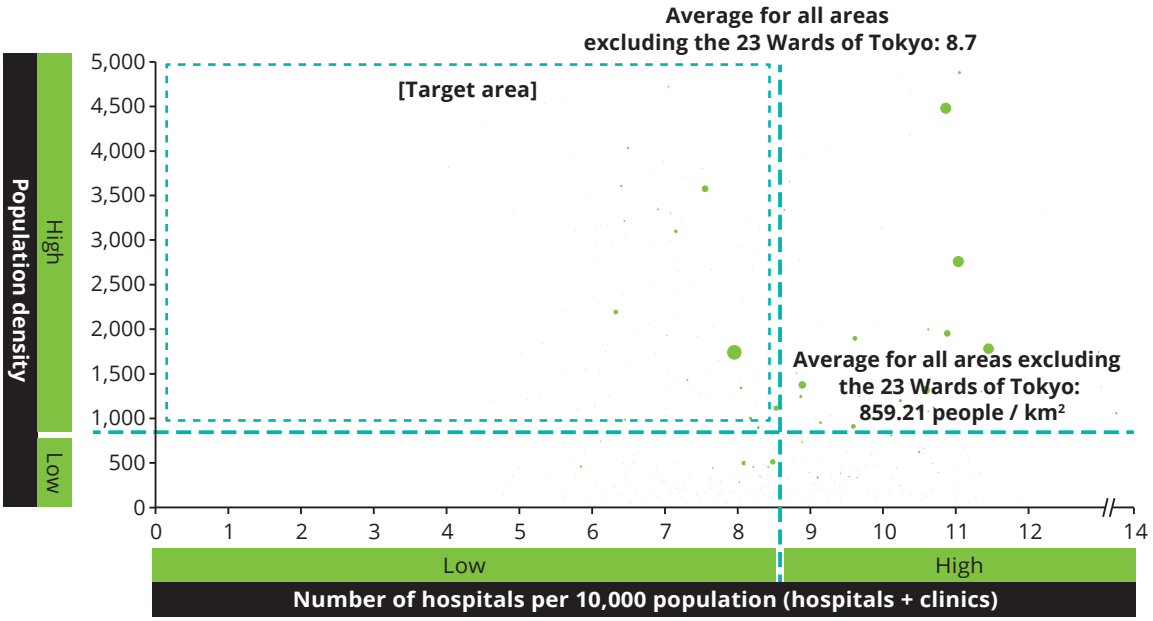
We also believe it will be possible to identify areas that would benefit from such initiatives in the following manner, based on the aforementioned classification by population density and density of medical facilities.
For specific figures, we calculated the population density of each city/town/village and the number of medical facilities (hospitals + clinics) per 10,000 population and divided each city into four quadrants based on the average values (859.21 persons per km and 8.7 facilities per 10,000 people). Of these areas, we assumed that the upper left area with above-average population density and below-average distribution of medical facilities would be the target area for "hospital visit support type" medical MaaS. The 23 wards of Tokyo were excluded from the calculation, as the values for both categories are exceptionally high. Target areas where "hospital visit support type" medical MaaS could be highly suitable include Chiba City, Niigata City, and Sapporo City, for example.

Expected results for medical MaaS participants

Finally, we have listed the results that can be expected by participants in this concept below.

- Medical facilities
  Medical facilities can expect an increase in the number of patients from patients who have dropped out of treatment being encouraged to return for a follow-up visit. It is also said that the COVID-19 pandemic, which began in earnest in 2020, has reduced the number of patients coming in for treatment, but if transportation with appropriate infection prevention measures can be provided, it will be possible to capture demand from patients who have stopped seeing physicians out of fear of infection.
- Transportation operators
  For transportation operators, securing long-term vehicle dispatch reservations will make it possible to level out peaks and valleys in driver utilization. This

Figure 3-3: Target area for "hospital visit support type" medical MaaS



Source: Extracted and organized by Deloitte Tohmatsu Consulting based on cities/wards/towns/villages with hospitals registered in e-stat with populations of over 50,000 people, 50 or less hospitals per 10,000 population, and a population density of 5,000 people / km2 or less (those exceeding this were assumed to have low MaaS service needs due to high accessibility)

could enable formulation of measures for increased sales and reduced costs, such as reducing idling time and concentrating resources in high-demand areas. This is expected to lead in turn to improved driver retention and increased work-life balance.

- Local governments
  For local governments, medical MaaS will reduce future medical and nursing care costs by encouraging patients with chronic diseases to continue treatment, thereby preventing their diseases from becoming serious. The results are expected to be even greater if coupons encouraging exercise and the purchase of disease-preventive foods can be distributed in collaboration with companies at stopover locations. Furthermore, since medical MaaS will encourage the elderly to go out independently, it can be expected to stimulate economic activity in the region.
- Stopover location companies
  Simply put, stopover location companies can expect results for attracting customers. In addition, coupon distribution will encourage consumption, and can be expected to increase the purchase price per customer.

4. Medical MaaS demonstration case: Chiba City initiatives

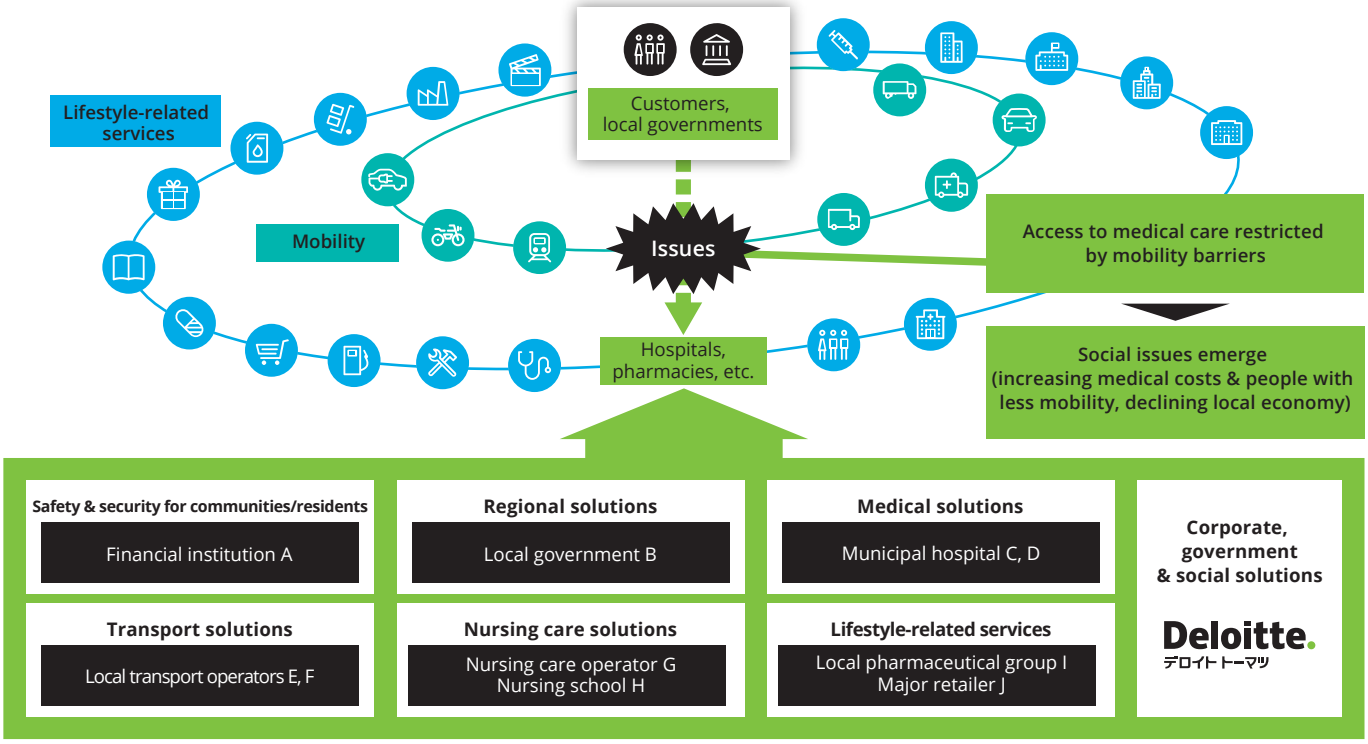
In this section, we give an overview of the medical MaaS demonstration case performed in Chiba City from May to August 2022.

1. Demonstration summary

The demonstration experiment in Chiba City based on the aforementioned initiative was performed according to the following summary.

- **Objective:** Demonstrate business feasibility and improvement of the hospital visit experience through improving mobility access
- **Implementation structure:** Financial institutions led the demonstration, which was conducted by Deloitte in collaboration with nine organizations
  - Financial institutions: Provision of funding for the demonstration and MaaS app
  - Chiba City: Coordination of local stakeholders
  - Municipal hospitals (two facilities): Provision of demonstration location
  - Transportation operators (two operators): Provision of means of transportation
  - Nursing care operators and nursing school: Provision of nursing care support for patients requiring nursing care
  - Pharmacy group: Provision of digital coupons that can be used at group stores
- **Demonstration area:** All areas of Chiba City
- **Demonstration period:** May 9, 2022 to August 10 of the same year

Figure 4-1: Medical MaaS implementation structure



- **Targets:** Patients with chronic diseases residing in Chiba City (demonstration was performed without identifying disease names)
- **Demonstration details:** Transportation operators visit the patient on the medical appointment date pre-registered in the dedicated app and transport the patient to the medical facility. After the examination, another reservation is made for a taxi to visit a stopover point, where the patient takes care of their errands and then returns home.
- **Investigation details:** In addition to checking each user's satisfaction level, etc., with this concept, we also verified changes in the hospital visiting experience. For transportation operators and retails, we investigated economic results such as sales

2. Demonstration results

In this demonstration experiment, 77 people were approached at medical facilities and asked to register for the dedicated application. Of these, 41 actually installed the dedicated application, and 13 actually became users of the application.

Of these 13, 9, or approximately 70%, used the service more than once. The users tended to be relatively close to the hospital from their homes (i.e., a transportation time of 30 minutes or less), and there was a strong trend for many of them to use taxis as their usual means of transportation to the hospital.

83% of respondents stopped using the app during the process between app registration to actual use of the app, suggesting that the complexity of the app registration process is a significant hurdle. The expected effects of this concept were assessed through a post-use survey of 13 people who actually used the app, and additional qualitative research through further interviews with six people.

The investigation results for this concept are described below.

Confirmation of evaluation perspective "1: Patient satisfaction level and changes in the hospital visit experience for this concept"

First, there seems to be a high user satisfaction level in this demonstration experiment. Of five possible points for satisfaction, the users' average score was four points, and five out of six users gave scores of four points or more. For their reason for using the service, users gave the following reasons: "Because I normally feel it is inconvenient to go to the hospital," "Because I found it easy to reserve a taxi through the app," and "Because it is cheaper and faster than a regular taxi". We were also able to confirm that users felt actual improvement in their hospital visit experience. As for results from using the service, 100% of users (6/6) said they "found it more convenient compared to their usual way of visiting the hospital", 100% (6/6) said that "the time it takes them to arrive at the hospital has been reduced compared their previous way of visiting the hospital", 100% (6/6) said that "using this concept has reduced the burden of visiting the hospital", 50% (3/6) said that "they feel more inclined to go outside", and 83% (5/6) said that "it is easier to visit the hospital as scheduled compared to their usual way of visiting the hospital".

Furthermore, respondents' reasons for feeling that their hospital visit experience had changed were as follows: 67% (4/6): "Because I can make a reservation in advance with the app", 83% (5/6): "Because a taxi will pick me up on time for the appointment", 83% (5/6): "Because the taxi will come to my house". Thus, it was shown that there was a strong favorable impression for the hospital visit experience as well as the service's ability to address demand for stress-free transportation by comprehensively resolving the inconvenience in users' usual methods of visiting the hospital. We found a potential source of demand from the perspective of consumers who tend to find reasons not to go outside to be more -or-less compelled out.

Interviews with users revealed that assurance of having secured means of transportation for their next appointment to visit the hospital was a source of psychological reassurance for the patients. Chronically ill patients with mobility-related issues are at high risk of discontinuing their hospital visits due to changes in their physical condition on the day of the visit or inability to secure transportation in the event of inclement weather on the day of the visit. However, at medical facilities with a large number of patients, such as the municipal hospitals that participated in this demonstration, if a patient reschedules an appointment, he or she will have to wait a long time until the next appointment date. In addition, being late for an appointment means that a patient will have to wait for a long time before his or her turn comes again. Because of this, we assume that patient's being assured of a taxi's arrival creates a sense of psychological security, and this increases their level of satisfaction with this concept. The interviews also confirmed users' needs for freedom of movement as well as demand for one-stop service completion and peripheral services necessary to achieve on-time travel, such as payment, linkage with ancillary operations such

as hospital appointments, price discounts for use on rainy days, and provision of medical information.

Confirmation of evaluation perspective: "2. Economic results for transportation operators and retailers"

We were able to confirm two economic results from this concept through our interviews with transportation operators.

- Increase in new customers
  Of the 77 registrants, about 30% or less corresponded with the existing customer ratio of the transportation operators who cooperated with us this time. In other words, over 70% of the registrants for this concept were new users for these transportation operators. This can lead to opportunities where patients who formerly took public transportation or drove themselves or family members to hospital visits use a taxi instead, which will lead not only to a pure increase in sales but also to reduced marketing costs. The patient survey revealed that there is a need for "stress-free transportation that comprehensively resolves the inconvenience in users' usual methods of visiting the hospital", and we surmise that developing hospital visit support services ahead of competitors will be an element that transportation operators can use to differentiate themselves.
- Operational stabilization
  Second, both companies and drivers say that being able to see the status of reservations in advance is a source of reassurance and helps stabilize operations. One additional point here is that, although this may vary based on the transportation operator and the driver's employment status, in general, drivers' salaries consist of a fixed salary and a commission. Consequently, transportation operators do not specify how the driver will spend the day. Since there is no liability for sales, the drivers look for passengers based on their own experience and intuition, which results in their operations being unstable. It can be surmised that changing this so that passenger reservations are filled up like a bus timetable would lead to stabilization. However, drivers expressed resistance to any change from current operations due to concerns such as possible loss of opportunities to pick up passengers for longer distances.

The economic results for retailers could not be clearly investigated because use was limited to only one person this time.

Based on the responses from three interviewees, we assume that users did not use the stopover service due to the following reasons: "Concerns about time spent waiting for a vehicle at a stopover", "lack of a potential stopover location" and "user already makes use of a pharmacy located near his or her home". Since the one person who actually used the drop-off service (a person who shared a vehicle with his/her elderly parents) responded that "since we need to buy all of our daily necessities at once, the service was very helpful", we assume that if users can be gotten to actually use the service, this could lead to increased user satisfaction and attract more customers to the retailer.

3. Issues and solutions revealed by the demonstration

In this demonstration, we have identified the following four issues and points for improvement aimed at implementation.

Awareness of service

In this demonstration, we tried to spread awareness of the service by giving explanations aimed at visitors in medical facility lobbies. However, issues were identified with the efficiency of the screening process, as the number of people we were able to talk to was limited, and more than half of those who received explanations had already secured transportation in the form of a private car.

When actually launching a business, it will be essential to take measures to efficiently gain awareness of the service such as having local governments publicize the service to residents, or introducing the service to facilities like nursing homes where multiple users can be expected.

Establishment of a system

As mentioned above, for "hospital visit support type" medical MaaS, it will be important to have close coordination with medical appointments for securing long-term vehicle dispatch reservations. Therefore, it would normally be considered essential to build a medical appointment / vehicle dispatch reservation system that can confirm the need for a vehicle dispatch reservation at the time of a medical appointment and, if necessary, secure a vehicle dispatch reservation on the spot. However, direct linkage with medical appointment systems is difficult, as the reservation system for large hospitals is directly linked to the electronic medical record system, and external access would require

modification of the electronic medical record system. At the same time, many small clinics have not adopted a medical appointment reservation system in the first place.
In this demonstration project, a system was adopted that allows users to search and enter their own taxi dispatch reservations based on medical appointment information that has already been confirmed. However, this is no different from making a vehicle reservation through an existing vehicle dispatch platform, and does not address the patient pain point of "difficulty in securing a means of transportation to the hospital on the day of an appointment (especially in inclement weather)".
Uber Health avoids this problem by having hospital staff enter the Uber reservation from the app when the patient makes a reservation at the hospital, but it would be difficult to adopt a similar system in Japan, where hospital personnel are too busy with their work.
In order to solve this issue, it will be necessary to establish a mechanism to reduce the burden on users operating the app as much as possible. An example of this would be building an algorithm to automatically set up vehicle dispatch and routes for the day of a medical appointment (in the case of ridesharing, the shortest route including each user's ride location) immediately once the user has registered the date and time of his or her appointment, the pick-up location, and the name of the medical institution.

Design of a user-friendly UI/UX

From the perspective of physical function, it is mainly the elderly who have difficulty in going to the hospital. Although the penetration rate of smartphones among the elderly is said to have increased rapidly in the three years of the COVID-19 pandemic, many still do not have smartphones or, if they do, find it difficult to operate complex apps.
In this demonstration, too, there were a certain number of people who were willing to participate but did not because they did not have a smartphone, and there were also some who gave up registering due to errors that occurred from mistakes made using the app during the initial registration process. In light of this, services should be designed with the elderly in mind (e.g., UX/UI design that enables family members to perform operations, advanced support through call centers, etc.).

Transportation costs

This demonstration experiment was limited to taxis as the means of transportation, and the cost burden for taxi use was a bottleneck for people who do not normally use taxis. Regardless of if someone is elderly, part of the younger generation, or someone who already has a disease, there is a clear desire for mobility at the lowest possible cost. Even when someone clearly has difficulty in getting around, transportation via private car or the person's "tolerance" for using public transportation prevails. This is an anticipated barrier; as the population ages, this "tolerance" will become more difficult, and a fundamental solution will end up being postponed, with patients instead choosing to put off getting treatment or switching their hospital visits to a location that is closer to them.
We were given renewed understanding that for residents, it will be vital that the activity of moving, which produces nothing, be transformed into an activity that connects to something else.
Another effective measure would be to reduce costs through ridesharing. In the interviews with users, some actually said they would be willing to continue using the service if they could get a 20-30% discount on the regular taxi fare by sharing a ride, suggesting that the price elasticity of this concept is quite high.

5. Deloitte's suggestions aimed at future service development

In this section, we present our views on the ideal "hospital visit support type" medical MaaS service for future service development based on the results of the demonstration in Chiba City, focusing on logic and specific ideas for expanding monetization, which was not considered in the demonstration but is an important element for maintaining sustainable services.

Logic for expanding monetization

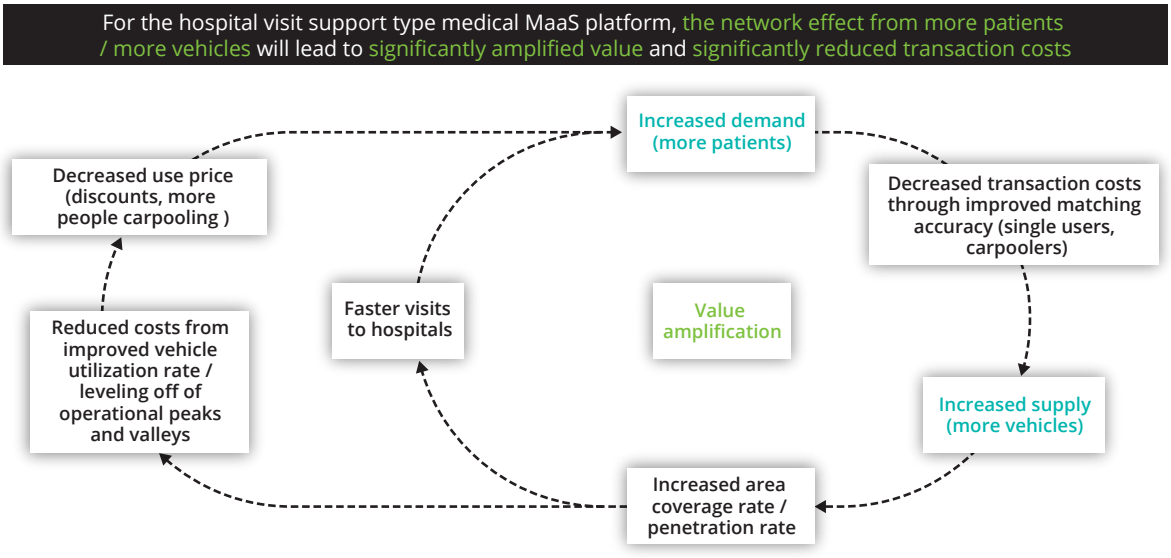
In general, healthcare business monetization, including for this concept, can be classified into two types of companies: primary use business, in which user data collected from services is directly used to resolve pain points (in this case, the vehicle dispatch business), and secondary use business, in which collected data is anonymized and provided to third parties. We consider the KSFs for each business to be as follows.

1. Primary use business KSFs: Vehicle dispatch business

The key is to maximize customers' Life Time Value (LTV) by providing a group of solutions that can cover a wide range of pain points in the healthcare value chain, while having patients continue to stay on the platform.
In order to have customers continue to stay on the platform, an essential factor will be proper execution of the value amplification cycle using the network effect between users and producers. Value amplification refers to the mechanism by which an increase in the volume of demand decreases the cost of transactions with suppliers, thereby continuing to amplify the overall value of the service.
We assume that for the "hospital visit support type" medical MaaS platform, value amplification will be created as follows.

- More patients using the service will increase vehicle matching (single and carpool vehicles) accuracy, thereby lowering transaction costs for vehicle dispatch operators in finding users on the day of a dispatch
- More vehicle dispatch operators using this concept will increase the coverage rate for the area and the hours in which the service is available

Figure 5-1: Value amplification mechanism of the "hospital visit support type" medical MaaS platform

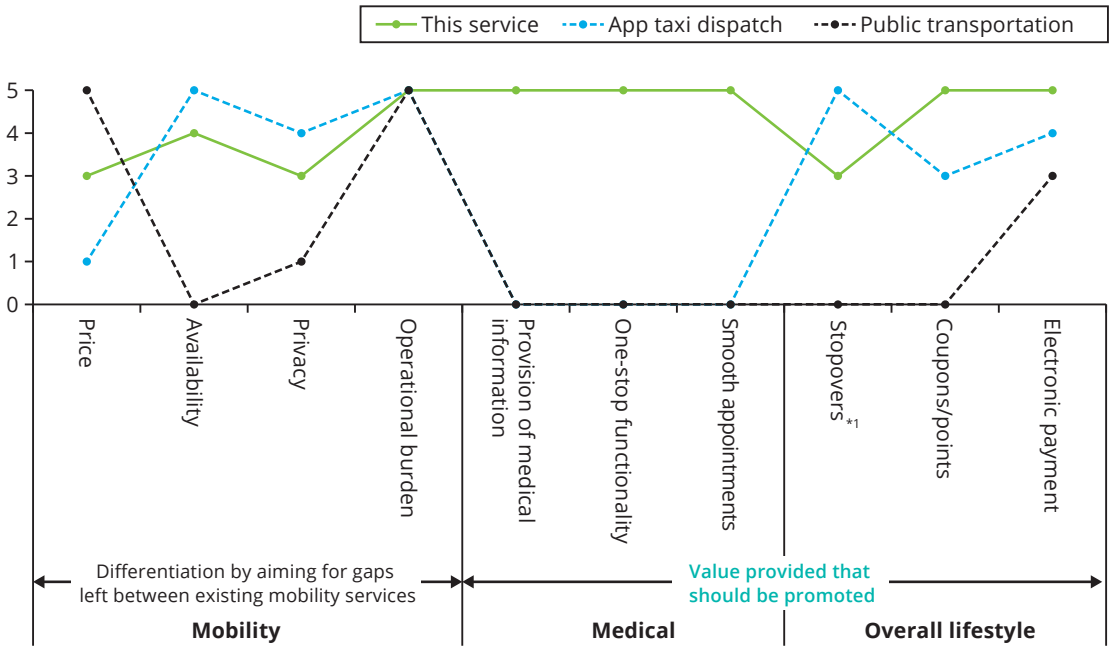


- More vehicles for picking patients up at the optimal time for them and carpooling at convenient times and routes will allow patients to visit hospitals at a time that is convenient for them
- In addition to the above, having more users will increase the vehicle utilization rate. It will also increase the number of long-term reservations, which will have significant results for leveling out the utilization rate, thereby reducing costs for vehicle dispatch operators
- Cost savings will be passed on and discounted from the user price, and a reduced price per user from more carpoolers will lead to a further increase in the number of patients using the servic

For this value amplification to occur, it is first necessary to increase the number of patients using the service as much as possible. Because of this, it will be important to widely publicize the value of this concept to the expected customer segments (e.g., patients with chronic diseases requiring regular hospital visits, perinatal women, families with infants expected to develop sudden fevers, etc.). This concept is designed to solve the issues faced in both conventional taxis and public transportation. Therefore, we have established the value of this concept in the form of a comparison to both as shown in the value curve in Figure 5-2.

When we look at the service as a means of providing transportation, it is differentiated from public transportation by its private and on-demand nature, and for differentiation from taxis, it will be necessary to aim for this through the price. Therefore, future adoption of the ridesharing method is an essential factor for this concept. Sharing rides with other patients in the same area with similar appointment times at nearby facilities will allow for reduced fees compared to single uses. This is especially beneficial for users who live in the same residential facility, such as large apartment complexes and nursing homes. From a medical perspective, in addition to one-stop booking for medical appointments and vehicle dispatch, the unique value that should be promoted for this concept is its ability to facilitate smooth medical appointments without unnecessary waiting time by providing online medical questionnaires and medical information in advance. Other value that will appeal to elderly who coordinate their outings with visits to the hospital, and to perinatal women, is the inclusion of stopovers for general everyday errands, provision of coupons to users that reduce costs based on long-term

Figure 5-2: Value curve for the "hospital visit support type" medical MaaS platform



*1: When using the carpooling method, privacy and freedom for making other stops is lower than for normal taxis

reservations, and use of electronic payment to allow users to also pay medical fees through the service. Meanwhile, to maximize LTV, it will be necessary to expand services other than hospital visits with the aim of resolving various pain points for patients who visit hospitals. For example, in the pain point analysis of patients with chronic diseases, in addition to barriers for hospital visits, it was found that patients have other "knowledge barriers" such as being unable to properly understand their own risks and not knowing the appropriate medical institutions to go to, as well as "psychological barriers" such as fear of treatment and concern for their families. These pain points do not erupt at the same time; rather, they change from moment to moment as the patient's treatment and symptoms progress. Because of this, it will be possible to secure continuous revenue from users with changing needs by preparing services that address these needs in advance.

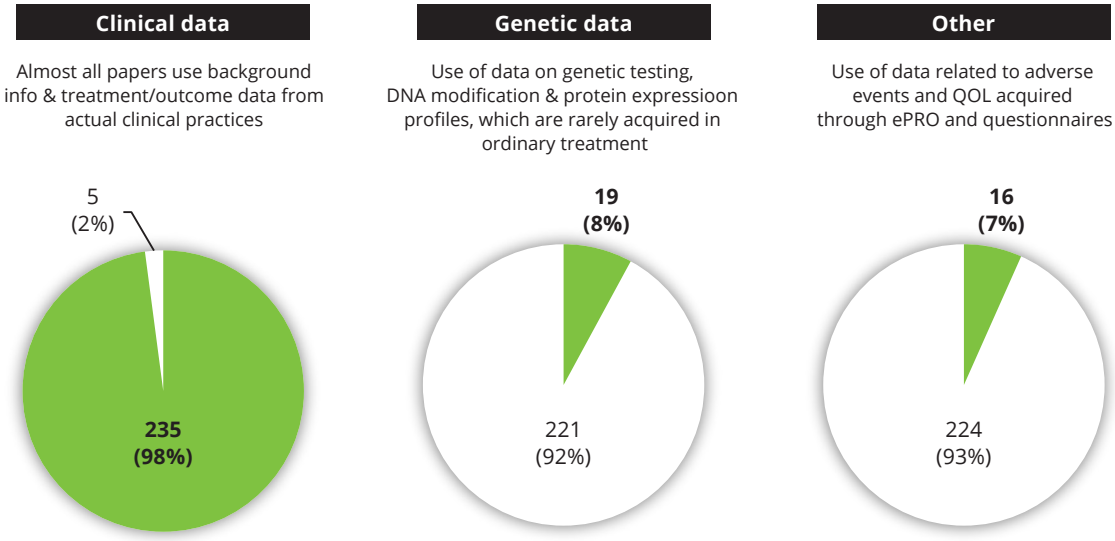
2. Secondary use business KSFs: Data utilization business

It will be necessary to increase the quantity and quality of data held in addition to mobility data, especially by obtaining medical data conducive to efforts by healthcare companies. Pharmaceutical companies are currently the largest users of Real-World Data, and EHRs have become a prerequisite as a source for medical background information on patients for use in marketing and R&D purposes.

Consequently, this business will also require collection of patient medical data (EHRs) in addition to mobility data. In general, utilization of medical data has not progressed in Japan, and one of the main reasons for this is the strong resistance that Japanese people show toward the use of personal information (for example there was a case where JR East's attempt to sell customers' Suica usage history in 2013 was met with a strong public outcry and the project was abandoned[11]).

This concept allows for the collection of basic information about patients' medical care (medical department, appointment date and time, name of medical facility) and their PLR (Personal Life Record), which includes the names of stopover locations and the amount paid for purchases made there. Monetization will require the collection of patient medical data (EHRs) in addition to these. In general, utilization of medical data has not progressed in Japan, and one of the main reasons for this is the strong resistance that Japanese people show toward the use of personal information (for example there was a case where JR East's attempt to sell customers' Suica usage history in 2013 was met with a strong public outcry and the project was abandoned[12]). Because of this, it will be necessary to devise ways to

Figure 5-3: Trends for utilization of RWD (oncology)



*Includes cases where multiple types of data apply

Source: Pubmed papers ron RWD use in the oncology field reported for the most recent three years were analyzed by Deloitte Tohmatsu Consulting

reduce backlash when collecting the data. This could include not black-boxing the purpose of use for patient data, limiting its use to purposes that facilitate patient treatment, implementing thorough explanation when obtaining user consent, and offering financial incentives which correspond to the amount of data provided. As a potential method for this initiative, when obtaining a customer's consent at the start of service use, the amount for the coupons provided to him or her could be varied according to the amount of data provided. According to the results of our survey of patients with chronic diseases in Japan, more than 60% of the respondents answered that they would be willing to provide their medical data if it is used to facilitate treatment. This indicates that consent to use data could be obtained from a high percentage of Japanese, who are cautious about data use, if transparency is ensured. As a case example of incentivizing data provision, Nebula Genomics in the U.S. has implemented a system in which virtual currency is issued and offered as remuneration in exchange for actual genetic data provided. To collect EHRs, in addition to obtaining patient consent through the service platform, it will also be also necessary to collaborate with the EHR manufacturers that actually store the data. A process will need to be established in collaboration with EHR manufacturers with high market shares, such as Fujitsu for hospitals and PHC for clinics, where EHRs for consenting patients are transferred from the EHR vendor database to the database for this concept. Since EHR manufacturers will be core business partners, when conducting the data secondary use business, it will be necessary to consider close collaboration and joint ventures with manufacturers who are interested in similar business.

Combining PLRs and HERs will make it possible to analyze the relationship between a patient's daily activities and disease prognosis, and if PHRs can be collected through a combination of services such as wearable devices, this will allow further expansion of the data utilization range.

As of 2022, the secondary use market for medical data is worth approximately 130 billion yen, with pharmaceutical companies as the largest customers. Based on a bird's-eye view of the current pipeline of pharmaceutical company demand, it can be assumed that the overwhelming majority are in the field of oncology. Therefore, it will also be effective from a business perspective to establish the customers for hospital visit support as those receiving treatment in the field of oncology due to is high pharmaceutical company demand.

Specific ideas aimed at expanding monetization

Below we go over specific methods and references cases based on the previous section's suggestions on logic for expanding monetization.

1. Optimizing primary use business LTV: Building a regional platform

As mentioned earlier, creating value amplification for this platform will first require increasing the number of patients using the platform as much as possible, and providing services to the entire population of a region will make it possible to maximize business in that region. Because of this, a regional platform will need to expand its functions beyond medical care and mobility to include a wide range of urban service areas such as education, security, environment, and energy.

As discussed in Section 2, since implementation of such a broad range of functions would be difficult for a single operator, it would be optimal to form a broad consortium of regional operators. Proactive participation by the government will also be indispensable in promoting collaboration that includes existing public services, and providing a wide range of services to residents. If the government can participate in expanding services from the residents' point of view, this will also increase services' reliability.

Examples of this include a demand-base bus operation initiative for running services at a regular time schedule during morning and evening rush hours (1-2 hours) and adjusting them based on user demand at other times of the day (Noruru in Takahagi City), and a joint initiative implemented with Obihiro City for having buses serve as mobile sales vehicles by carrying mixed freight and passenger loads and adding services to handle the increasing logistics volume at the end of the line (Tokachi Marche Bus). There are also active ridesharing initiatives in rural areas. These include initiatives where local governments recruit residents to become drivers, and residents are able to receive transportation to and from hospitals for as little as 1,000 yen, with the government subsidizing the shortfall, or which are operated with residents receiving amounts of few hundred yen (Nakatombetsu Rideshare and many others). There are also local governments that operate systems for private paid passenger transportation with operator cooperation, where residents receive kickbacks of a certain amount for each rideshare, allowing the services

to be run without relying on local transportation operators (Nokkaru Asahimachi). These are all examples of co-creation with regional operators.

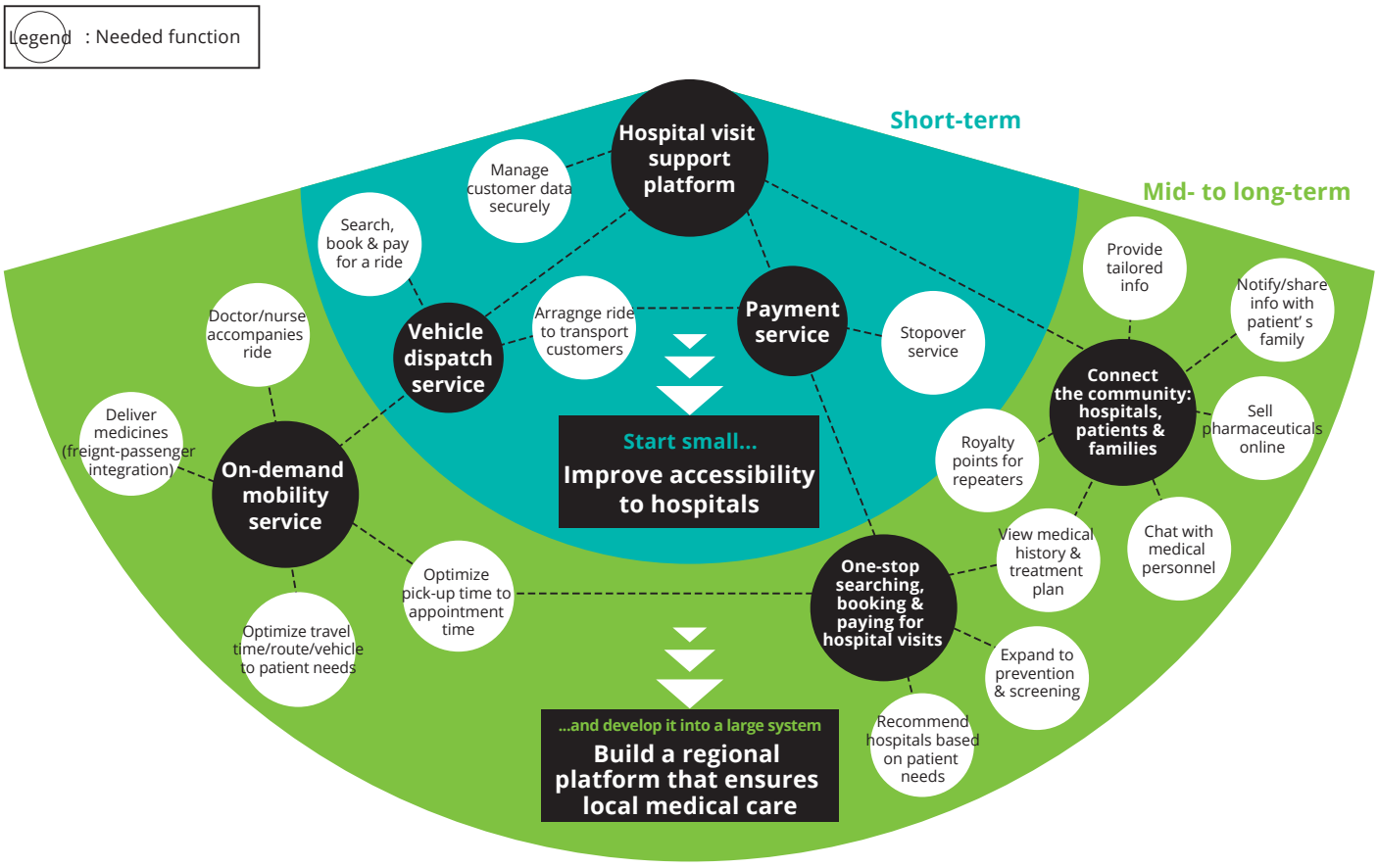
2. Improving value of data in secondary use business: Positioning urban OS as the core

It can be assumed that adapting this platform into a regional platform will lead directly to initiatives for an urban OS. As a part of public healthcare services, the ideal form of urban OS is placed in a perspective that is not limited to healthcare to enable analyzation of various data collected through a wide range of functions, from healthcare to mobility, finance, and residential communities, to identify potential needs for residents and help develop policies to satisfy these needs.

According to the Digital Agency's "Development of a Data Linkage Infrastructure," digitalization of transportation, medical care, education, and other areas should not be promoted individually, but rather the development of a data linkage infrastructure (urban OS) should progress through linkage between these fields, enabling further enrichment and enhancement of each initiative to achieve the ultimate vision of "well-being".

An urban OS is truly a means of giving shape to the mutual aid business. It requires thinking about sharing between the government and private sector, and also requires residents and resident participation. If the service is designed to maximize the benefit to residents and is one with a high degree of satisfaction and reliability, then residents will be willing to provide their personal information in order to use it. However, if the service is a black box where the residents are unable to see what their personal information will be used for, they will be hesitant to use the service out of

Figure 5-4 : Mid / Long – term expansion as a regional platform



fear. An urban OS is a means, not an end in itself. What is needed is a versatile vision of an urban OS that is tailored to the unique urban development in each region with urban services linked together. This is an effort that can never be achieved by a siloed, sectionalized organization.

6. In conclusion

In this paper, we investigate issues faced by local governments from a mobility and healthcare perspective, and the potential of "hospital visit support type" medical MaaS as a means of solving these issues. We also consider points for discussion and a future vision for service development based on the demonstration project in Chiba.
Japan's declining birthrate and aging population is expected to accelerate in the future, and the mobility and healthcare issues discussed here are certain to become more apparent in various local governments. We hope that this paper will help these local governments in solving their problems.

Authors

Yasuhiro Okawa

Partner
Life Sciences and Health Care
Deloitte Tohmatsu Consulting LLC

Kazuhide Masago

Senior Manager
Life Sciences and Health Care
Deloitte Tohmatsu Consulting LLC

Fumikazu Kitagawa

Partner
Core Business Operations
Deloitte Tohmatsu Consulting LLC

Atsushi Takahashi

Senior Manager
Core Business Operations
Deloitte Tohmatsu Consulting LLC

Contributors

Masahiro Ohashi

Senior Consultant
Life Sciences and Health Care
Deloitte Tohmatsu Consulting LLC

Endnote

1. Tokyo Metropolitan Geriatric Hospital and Institute of Gerontology survey (February 1, 2019)
2. The treatment discontinuation rate for patients with diabetes is reported to be 44%.
3. The Japanese Society of Public Health: “The Frequency of Going Outdoors, and Physical, Psychological and Social Functioning among Community Dwelling Older Adults”
4. FY 2020 Survey on Economic Conditions in Health Care (Ministry of Health, Labour and Welfare)
5. Nikkei Business Publications: Beyond Health (February 3, 2022)
6. Fact-Finding Survey on Procurement, etc., of Regional Public Transportation: Results of Survey (Ministry of Internal Affairs and Communications, January 2022)
7. Christopher Alexander: “A City Is Not a Tree”, Kajima Publishing
8. It was reported that adoption of Uber Health resulted in the medical appointment cancellation rate being reduced to 1/3rd (8% of Uber Health users vs. the industry average of 25 to 50%), and the cost for emergency transport of patients due to severe disease was reduced by 40 to 50% (The Verge: “Uber is driving patients to their doctors in a big grab for medical transit market” (March 1, 2018)
9. For example, chronic heart failure affects 6.2% of the elderly over the age of 75, and 50% of these patients are reported to go out less than once a day.
   (Japanese Journal of Public Health, Vol. 51, No. 3, "Physical, Psychological, and Social Characteristics by Frequency of Outings of the Elderly Living in Regional Communities")
10. The percentage of seniors with cognitive decline was reported to be twice as high after 8 months of refraining from going outdoors (27%) than after 2 months (12.6%).
    (Results of a survey conducted by Professor Kuno of Tsukuba University on 4,700 people aged 60 to 90 in Higashikagura Town, Hokkaido; Shirako Town, Chiba Prefecture; Mitsuke City, Niigata Prefecture; Yawata City, Kyoto Prefecture; and Misato Town, Saitama Prefecture)
11. Year 2017 WHITE PAPER Information and Communications in Japan: Recent high-profile case examples related to personal information (Ministry of Internal Affairs and Communications)
12. Year 2017 WHITE PAPER Information and Communications in Japan: Recent high-profile case examples related to personal information (Ministry of Internal Affairs and Communications)

Monitor
Deloitte.

Deloitte Tohmatsu Group (Deloitte Japan) is a collective term that refers to Deloitte Tohmatsu LLC, which is the Member of Deloitte Asia Pacific Limited and of the Deloitte Network in Japan, and firms affiliated with Deloitte Tohmatsu LLC that include Deloitte Touche Tohmatsu LLC, Deloitte Tohmatsu Consulting LLC, Deloitte Tohmatsu Financial Advisory LLC, Deloitte Tohmatsu Tax Co., DT Legal Japan, and Deloitte Tohmatsu Corporate Solutions LLC. Deloitte Tohmatsu Group is known as one of the largest professional services groups in Japan. Through the firms in the Group, Deloitte Tohmatsu Group provides audit & assurance, risk advisory, consulting, financial advisory, tax, legal and related services in accordance with applicable laws and regulations. With approximately 17,000 people in about 30 cities throughout Japan, Deloitte Tohmatsu Group serves a number of clients including multinational enterprises and major Japanese businesses. For more information, please visit the Group's website at www.deloitte.com/jp/en.