

## Field report

# The disparity of utilization rate among specific groups for a rapid spreading telehealth application called LEBER during the COVID-19 state of emergency in Japan

Yurie Kobashi<sup>1,2</sup>, Masaki Oguni<sup>2</sup>, Masaharu Tsubokura<sup>1,2</sup>, Naoki Kanda<sup>3</sup>, Naomi Ito<sup>1</sup>, and Shunichiro Ito<sup>2</sup>

<sup>1</sup>Department of Radiation Health Management, School of Medicine, Fukushima Medical University, Japan

<sup>2</sup>LEBER Inc., Japan

<sup>3</sup>School of Medicine, Fukushima Medical University, Japan

### Abstract

**Objectives:** The purpose of this research is to describe the social demographics and chief complaints of users of a free medical consultation application in Ibaraki Prefecture, where a free medical consultation application was released.

**Methods:** The present study included users of a telehealth application in Ibaraki Prefecture between April 9 and May 17, 2020, during the state of emergency. User background characteristics were descriptively analyzed to clarify individual factors with the potential to act as barriers to equally using innovative solutions. Additionally, the age and consultation time distribution by sex were examined for those who used the application for COVID-19 and non-COVID-19 issues.

**Results:** Most of the participants were in their thirties. Moreover, 72% were female, with most being in their thirties (86%) and the least being in their sixties (45%). The number of consultations was concentrated between 6 p.m. and 10 p.m., with the least between 1 a.m. and 5 a.m. The telehealth application users were mainly females in their thirties and forties.

**Conclusions:** To prevent the widening of health disparities due to the rapid introduction of telehealth, further research is required to identify why the use of the application did not spread beyond the aforementioned user groups.

**Key words:** telehealth, coronavirus disease 2019 (COVID-19), state of emergency, Japan, disparity

(J Rural Med 2023; 18(4): 233–240)

### Introduction

Pandemics adversely affect health equity in various ways; more specifically, the COVID-19 pandemic has greatly increased health inequality<sup>1,2</sup>. The appropriate allocation of resources and prevention of viral exposure to healthcare workers were essential to prevent the collapse of the medical care system during the COVID-19 pandemic<sup>3</sup>. Therefore,

innovative solutions are required to adapt to the COVID-19 pandemic era. Thus, establishing innovative health solutions to prevent an increase in health disparities caused by COVID-19 is a crucial public health issue.

The pandemic has fostered the creation of innovative solutions in challenging times<sup>1</sup>. In particular, telehealth has become vital because it can provide medical services while minimizing transmission risk. Additionally, it can provide medical care to those who are medically or socially vulnerable without ready access to providers<sup>4</sup>. Moreover, telehealth has already been introduced in many countries during the recent COVID-19 era. With the rapid introduction of telehealth, the utility ratio differs for each group, which may cause additional disparity<sup>5</sup>. Thus, the effective utilization of telehealth is crucial for clarifying the characteristics of telehealth users. However, few studies have been conducted in this area.

The COVID-19 outbreak has also been rampant in Ja-

Received: November 1, 2022

Accepted: June 5, 2023

Correspondence: Shunichiro Ito, LEBER Inc., Takano, Tsukuba city, Ibaraki 300-2642, Japan

E-mail: shun@leber.jp

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pan. As of September 26, 2020, 81,055 people have been infected<sup>6</sup>). Due to the rapid increase in the number of COVID-19 patients in Japan, a state of emergency was declared in seven prefectures on April 7, 2020, and expanded nationwide on April 16. Following this declaration, 13 prefectures were allocated as “prefectures under special precautions” to achieve infection control. After the COVID-19 pandemic outbreak, the telehealth department was fostered by the reconstruction of systems and national insurance remuneration for telehealth, by the government’s active promotion campaign, and by the increase in telehealth demands from patients and users; telehealth has spread rapidly in Japan<sup>7, 8</sup>).

More specifically, Ibaraki Prefecture, which is located in the Kanto area, provided a telehealth consultation service to residents free of charge using a previously created application to reduce anxiety associated with COVID-19<sup>9</sup>). Hence, the use of telehealth consultations spread rapidly in this area during the state of emergency.

The purpose of this research was to describe the social demographics and chief complaints of users of a free medical consultation application in Ibaraki Prefecture, which might help clarify the types of individual factors that function as barriers to the equal use of innovative solutions in the future. This area was chosen because a free medical consultation application was rapidly released during the first wave of the COVID-19 outbreak, which was curbed to a great extent by the state of emergency imposed by the government.

## Methods

This study is a descriptive observational study.

### Settings related to COVID-19

A state of emergency was declared in eight prefectures, namely, Tokyo, Ibaraki, Chiba, Saitama, Kanagawa, Osaka, Hyogo, and Fukuoka, on April 7, 2020, and expanded na-

tionwide on April 16; following this, 13 prefectures, including Ibaraki, were allocated as “prefectures under special precautions” to achieve infection control. During this time, voluntary restraints regarding going outside and the closing of businesses and stores were also required. On May 14, 2020, the state of emergency was lifted due to a decrease in the number of patients in 39 prefectures, including Ibaraki. Later, on May 18, 2020, Ibaraki Prefecture gradually removed restrictions on going outside and the closing of businesses and stores, thus allowing for the resumption of socioeconomic activities. The state of emergency was lifted in eight other prefectures, including Tokyo, on May 25, 2020.

### Application

LEBER is a telehealth application for medical consultations developed by medical doctors and produced by LEBER Inc. It was started in Tsukuba City, Ibaraki Prefecture in January 2018. This application supports self-care and self-medication for both healthy and mildly ill patients. An original application download was required to use LEBER. Users can obtain medical advice from medical doctors, such as hospital recommendations, medical departments, and over-the-counter drugs, by matching with appropriate medical doctors and having subsequent medical consultations using chatbots. The flow of LEBER is presented in Figure 1.

A verification survey indicated that LEBER alleviated patient symptoms and anxiety, and decreased the burden on medical staff through appropriate triage<sup>10</sup>). The average time doctors take to provide answers is 3 minutes and 30 seconds, and 90% of consultations are answered within 30 minutes using cloud-based robotic process automation technology. For children, parents mostly consulted on their behalf; however, we did not obtain detailed data on this type of consultation. As of August 2020, the number of user accounts exceeded 90,000, the number of consultations exceeded 20,000, and the number of registered doctors exceeded 300.

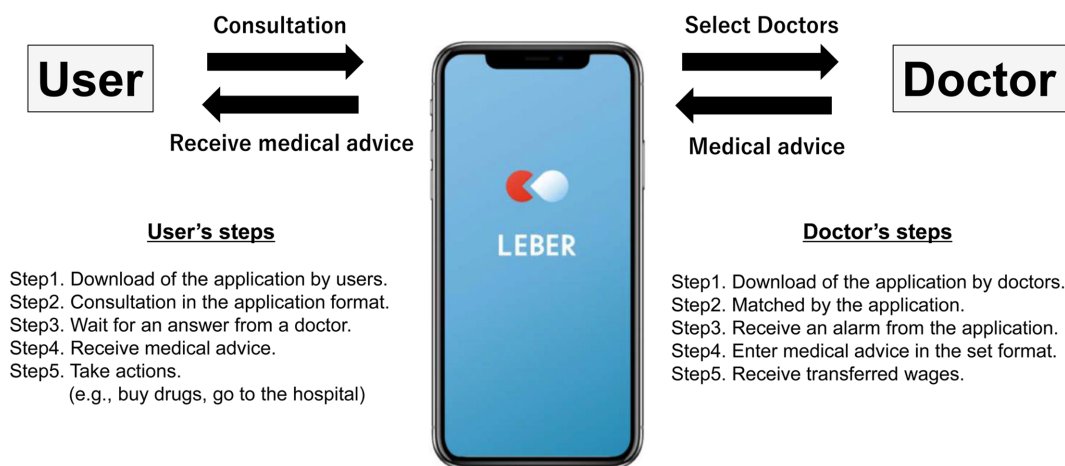


Figure 1 The flow of using LEBER.

After the state of emergency, LEBER was provided free of charge to all residents in Ibaraki Prefecture by the local government between April 9 and September 30, 2020.

## Data set

A database containing information on LEBER users from the LEBER head office was used in this study. Data, including age, sex, date and time of use, and chief complaints, were obtained from the database. Chief complaints were divided into two categories: consultation for COVID-19 and consultation for non-COVID-19 issues. Each of the two categories consisted of two parts: symptom consultation, in which users selected their symptoms from prepared choices, and free consultation, in which users described their chief complaints in their own words, with no word limits. For users of the symptom consultation for COVID-19, we obtained data on the details of symptoms and patient characteristics, as well as past medical history.

For symptom consultation for the non-COVID-19 category, 139 chief complaints were acquired because of the structure of the application, which were classified into 27 major chief complaints under discussion by the authors (YK and MT).

For the free consultation for the non-COVID-19 category, the chief complaints in each of the patients' original sentences were categorized into 28 major chief complaints by the authors (YK and MT) (the aforementioned 27 major chief complaints and consultation on whether the user should go to the hospital).

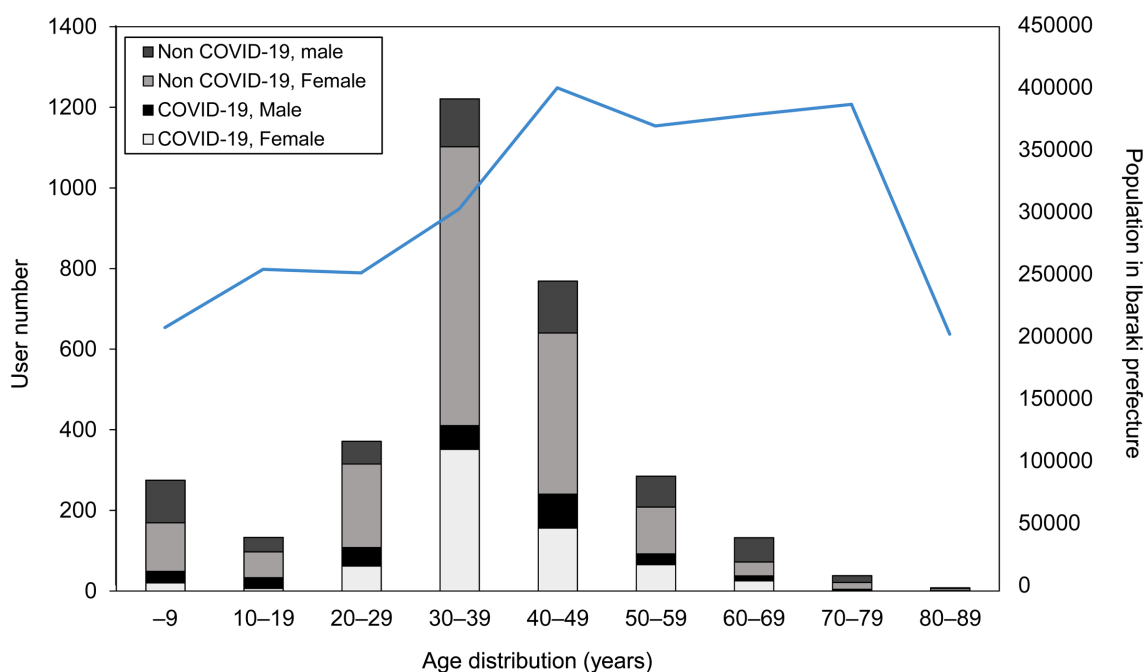
For consultations about COVID-19, the users of "symptom consultation" mainly had symptoms, while the users of "free consultation" did not always have any of the symptoms but wanted to consult a doctor about infection protection, advice on visiting hospitals, and so on.

## Data definition

The inclusion criteria were users who spontaneously used LEBER between April 9 and May 17, 2020 when LEBER was provided free of charge to Ibaraki Prefecture residents during the period when voluntary restraint was mandated in terms of going outside and closing businesses and stores as part of the state of emergency. Apparent duplicates of data from patients who underwent multiple consultations for COVID-19 were excluded.

## Analysis

User background characteristics were descriptively analyzed to clarify the individual factors with the potential to be barriers to the equal use of innovative solutions in Ibaraki Prefecture. Next, the age distribution and consultation time distribution by sex are presented in the Figures 2 and 3 for each age group (both users who consulted for COVID-19 and non-COVID-19 issues). Differences in the median age by sex of users for COVID-19 and non-COVID-19 issues were statistically analyzed using the Wilcoxon rank-sum test. Moreover, the proportion of the sex of users per hour categories (0 a.m.–6 a.m., 6 a.m.–0 p.m., 0 p.m.–6 p.m., and 6 p.m.–0 a.m.) were statistically analyzed using



**Figure 2** Age distribution by sex of users who consulted about COVID-19 and non-COVID-19 issues. COVID-19: coronavirus disease 2019.

the chi-squared test. Third, details of symptom information and characteristics of COVID-19 patients and the chief complaints of non-COVID-19 patients were descriptively analyzed.

A statistically significant *P*-value was set at 0.05. STATA IC (version 15; Lightstone, TX, USA) was used for the analysis. This study was approved by the Ethics Committee of LEBER Inc. (Ethics Committee ID: 20-04) and the Ethics Committee of Fukushima Medical University (Ethics Committee ID: 2021-191); the opt-out consent process was used in this study.

## Results

After excluding 18 users for duplication and missing data, 3,232 participants who used the LEBER application in Ibaraki Prefecture between April 9 and May 17, 2020 were included in the analysis. The participant characteristics are presented in Table 1. Of these, 28% were men, and the median age (25th and 75th percentiles) was 36 years (30, 45). Participants under 19 years of age comprised 13%, those over 65 years of age 2.6%, and those between 20 and 39 years of age 49%. Consultation-associated COVID-19 comprised 30% of all groups.

The age distribution by sex of the users who consulted about COVID-19 and non-COVID-19 issues is presented in Figure 2. Most users were in their thirties. The proportion of women in their thirties was the highest (86%), whereas that of those in their sixties (45%) was the lowest. The median age (25th and 75th percentiles) was 38 years (24, 49) for males and 36 years (32, 44) for females; thus, the median age

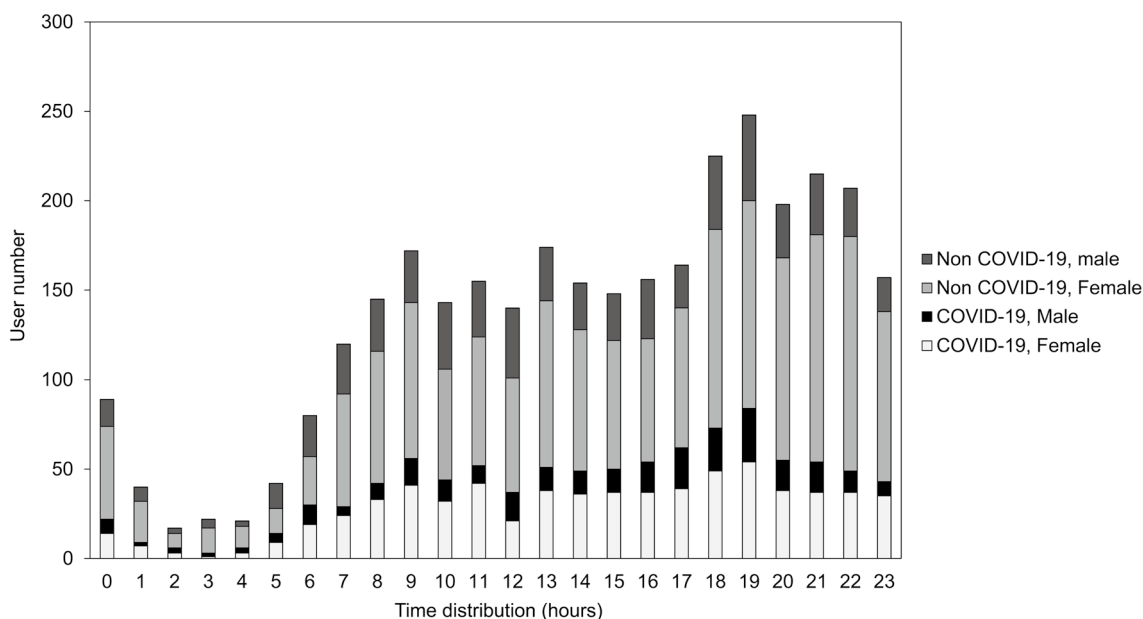
was higher in males ( $P=0.65$ , Wilcoxon's rank-sum test). The median age (25th and 75th percentiles) of the patients who consulted regarding COVID-19 was 37 years (25, 46) for males and 36 years (34, 45) for females; thus, this was statistically higher for males ( $P=0.037$ , Wilcoxon's rank-sum test). The population of each age group in Ibaraki Prefecture in 2020 is presented in Figure 2<sup>1)</sup>. The utilization rate of the application was low in among those in their 50s, 60s, and 70s compared to the population in Ibaraki Prefecture.

The consultation time distribution by the sex of users who consulted about COVID-19 and non-COVID-19 issues is presented in Figure 3. Consultations were concentrated

**Table 1** Patient characteristics (N=3,232)

	Number	%
Sex		
Male	890	27.54
Female	2,342	72.46
Age, median [25th, 75th centiles]	36 (30, 45)	
Chief complaint		
Consultation for COVID-19		
Symptom consultation*	786	24.32
Free consultation**	188	5.82
Consultation for non-COVID-19		
Symptom consultation	1,425	44.09
Free consultation	823	25.46

\*Symptom consultation means that users selected their symptoms from prepared choices. \*\*Free consultation means that users described their chief complaints in their own words. COVID-19: coronavirus disease 2019.



**Figure 3** Consultation time distribution by sex of users who consulted about COVID-19 and non-COVID-19 issues. COVID-19: coronavirus disease 2019.

between 6 p.m. and 10 p.m., and the lowest number of consultations occurred between 1 a.m. and 5 a.m. The proportion of male users at each time interval (0 a.m.–6 a.m., 6 a.m.–0 p.m., 0 p.m.–6 p.m., and 6 p.m.–0 a.m.) was 31%, 29%, 29%, and 25%, respectively, and the proportion of male users was the lowest during the 6 p.m. to 0 a.m. slot. A statistically significant difference between the sexes at each time interval was observed using the  $\chi^2$  test ( $P=0.026$ ). The utilization rate of males was significantly lower than that of females in all time intervals. Among the users who consulted for COVID-19, the proportion of male users at each time interval (0 a.m.–6 a.m., 6 a.m.–0 p.m., 0 p.m.–6 p.m., and 6 p.m.–0 a.m.) was 38%, 25%, 31%, and 30%, respectively, and the proportion of male users was the lowest during the 6 a.m.–0 p.m. slot. A statistically significant difference between the sexes at each time interval was not observed in the  $\chi^2$  test ( $P=0.12$ ).

Detailed information on the participants regarding free consultations for COVID-19 is presented in Table 2. Of these, the proportion of males was 35%, which was higher than the female proportion among all participants. The median age (25th and 75th percentiles) was 39 years (30, 47) among participants regarding free consultations for COVID-19. The proportion of participants with fevers over 37.5°C was 22%, and the most common symptoms, except for fevers, were sore throats, headaches, and coughs. Most users had symptoms such as the common cold, and only a few patients consulted regarding COVID-19 without symptoms.

The chief complaints in non-COVID-19 consultations, which accounted for 70% of the total, are presented in Table 3. The most frequent chief complaints were fevers and chills, skin problems, sore throats, or the sensation of having something stuck in the throat. Other chief complaints were symptoms of the common cold, skin problems, and symptoms associated with emergency diseases, mental problems, pain, and so on.

## Discussion

This research showed the social demographics and chief complaints of users of a free medical consultation application in the Ibaraki Prefecture, where the use of a medical consultation application spread rapidly during the state of emergency caused by the first wave of the COVID-19 pandemic in Japan.

This study found that women in the younger age group could initially adapt to innovative solutions in the healthcare field. Users in their thirties and forties comprised two-thirds of all participants, and female users comprised more than 70% of all participants. In Japan in 2017, the proportion of the population using the Internet exceeded 90% among those under 60 years of age; however, it declined sharply among those over 60: 73.9% among those in their 60s, 46.7% among

**Table 2** Patient characteristics of those who consulted for COVID-19 in detail (n=786)

	Number (%)
Sex	
Male	275 (34.99)
Female	511 (65.019)
Onset of fever	
From 4 months ago	135 (17.18)
From a few months ago	28 (3.56)
From a few weeks ago	125 (15.9)
From a week ago	99 (12.6)
From several days ago	167 (21.25)
From yesterday	104 (13.23)
From today	93 (11.83)
Unknown	35 (4.45)
Went to epidemic area	
Yes	122 (15.52)
No	647 (82.32)
Unknown	17 (2.16)
People who have a fever around you	
Yes	85 (10.81)
No	689 (87.66)
Unknown	12 (1.53)
Body temperature	
36.9°C	383 (48.73)
37.0–37.4°C	232 (29.52)
37.5–38.0°C	62 (7.89)
38.0–38.4°C	22 (2.8)
38.5+°C	87 (11.07)
Other symptoms (multiple choice)	
Sore throat	270
Headache	245
Cough	210
Nasal congestion	193
Feeling dull	169
Difficulty in breathing	133
Joint and muscle pain	121
Diarrhea	113
Nausea, vomiting	42
Abnormality of taste and smell	36
Eyes redness	26
Difficulty in urination	9
Spasm	4
Consciousness alert	5
No symptom except fever	70
Past medical history (multiple choice)	
Yes	111
No	493
Unknown	201

COVID-19: coronavirus disease 2019.

those in their 70s, and 20.1% among those over 80 years of age<sup>12</sup>). This decrease in application utilization is suspected to be a barrier among the elderly. Nevertheless, providing



**Table 3** Chief complaints for non-COVID-19 issues (n=2,258)

	Symptom consultation*	Free consultation**	Total	% (Total)
Fever and chills	273	38	311	13.77
Skin problems	128	30	158	7.00
Sore throat, the sensation of stuck in the throat	92	58	150	6.64
Psychological problems	89	50	139	6.16
Cough	88	47	135	5.98
Difficulty in breathing	46	47	93	4.12
Abdominal pain and tension	70	21	91	4.03
Chest pains	56	23	79	3.50
Consultation on whether the user should go to the hospital	–	75	75	3.32
Pain in the limbs	48	26	74	3.28
Nasal congestion and phlegm	38	32	70	3.10
Headache	44	23	67	2.97
Gynecology-related and breast problems	36	20	56	2.48
Itchiness	51	1	52	2.30
Back pains	48	3	51	2.26
Nausea, stomach oppression, and heartburn	29	16	45	1.99
Mouth problems	29	12	41	1.82
Eye problems	28	13	41	1.82
Feeling dull	25	15	40	1.77
Defecation problems	29	10	39	1.73
Lifestyle problems	7	28	35	1.55
Dizziness	30	4	34	1.51
Joint pain	30	2	32	1.42
Stiff shoulders and neck pain	23	7	30	1.33
Urination problems	21	7	28	1.24
Ear problems	19	9	28	1.24
Palpitation	20	2	22	0.97
Other	38	204	242	10.72

\*Symptom consultation means that users selected their symptoms from prepared choices. \*\*Free consultation means that users described their chief complaints in their own words. COVID-19: coronavirus disease 2019.

telehealth services to elderly people with major healthcare needs is vital. Thus, an interface that can be used by an aging population is required. Further research, including other telemedicine applications in Japan, is necessary to clarify the cause of the low application utilization among specific groups, although other groups did not have barriers toward Internet usage such as people in their twenties, fifties, and males. It might require not only sociodemographic but also attitudes toward telehealth, preferable for new technology, concern for telehealth, and others.

Furthermore, the data showed that free medical consultations offered by doctors were frequently used when users had difficulty accessing hospitals. The consultations were concentrated between 6 p.m. and 0 a.m. when the outpatient department was closed. This may be because the users' anxiety might have increased at times when they could not easily see doctors. Thus, telehealth could decrease the burden on medical institutions by reducing the need for patients to go to hospitals<sup>13</sup>. Among LEBER users, 64% who consulted for COVID-19 did not visit a hospital after using

the application. Thus, the application might have balanced the healthcare demand during a time when medical care was limited by providing numerous application consultations and reducing the number of hospital visits. Thus, regardless of the outbreak of a pandemic, teleconsultation applications should be promoted.

The teleconsultation application was used for patients with symptoms associated with COVID-19 and the common cold. Less than 10% of patients did not have any symptoms. Approximately 20% of users had a fever of 37.5°C or higher, and approximately 25% had a cough. Furthermore, many patients complained of common cold symptoms, such as sore throats, headaches, and nasal congestion. Some of these users contacted the public health center, which was assigned as the first contact institution for COVID-19 by the Japanese government, and were advised to stay at home. Previous studies on telehealth have reported that more patients consulted for symptoms during the COVID-19 pandemic than during the SARS pandemic<sup>14</sup>. It is worth noting that for the COVID-19 pandemic, telemedicine might be the most suit-

able way to monitor symptoms and provide support<sup>15</sup>). Furthermore, telehealth consultations by doctors might be of great help to users who have common cold symptoms and are required to stay home without testing, as such telehealth consultations will reduce their anxiety and guarantee safety.

A free medical consultation application by doctors provided responses to many types of chief complaints. These included common cold symptoms, skin problems, mental problems, pain, and symptoms associated with emergency diseases; consultations on whether users should go to the hospital were also common. Various chief complaints have been examined in previous telehealth research depending on the type of telehealth tool or platform and the target population<sup>16–18</sup>). Implementing telemedicine proactively rather than reactively would produce greater long-term benefits and would be useful in responding to urgent health challenges<sup>19</sup>). In this context, the accumulation of reliable data on telehealth is essential for the proactive implementation of telemedicine. Standardized questionnaires for chief complaints and triage are required in telehealth to accumulate reliable data. Moreover, it is necessary for sustainable telemedicine after the COVID-19 pandemic to be available on the platform, which can be used for many other diseases, including COVID-19.

This study has several limitations that should be considered when interpreting the findings. First, individual factors for identifying barriers to the equal use of innovative solutions are limited. Second, each chief complaint was divided into two type of consultations, namely, “symptom consultation” and “free consultation”, and chief complaints in free consultation were categorized manually, which might degrade the accuracy of chief complaints. Third, the present study included only information from LEBER application users, and we could not obtain information from other telehealth applications. Thus, comparing these findings with those of other studies would be difficult, and caution should be exercised when generalizing the findings of the present study. Fourth, we could not obtain information on user feedback, user ratings, probable diagnoses after hospital visits, or advice provided by the medical doctor. Further surveys are required, including the aforementioned information, to improve the telehealth system. Despite these limitations, this study is the first to provide information on the characteristics of telehealth users during the state of emergency in Japan.

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## Conclusion

This study found that telehealth application users during the state of emergency imposed by the government owing to COVID-19 were mostly females in their thirties and forties. Young women might be a good target to approach first when spreading a novel telemedicine application in an emergency period. However, special consideration may be required for males and the elderly when considering the widespread use of telemedicine services. Furthermore, to prevent widening health disparities owing to the rapid introduction of novel solutions, further research is required to identify why the use of the application did not spread beyond the aforementioned user groups.

**Author contributions:** All the authors made substantial contributions to this research. YK and MT contributed to the drafting of the manuscript and study design. MO and SI contributed to data collection and coordination with local stakeholders. All members contributed to the review of the final manuscript.

**Funding:** This research did not receive any specific grants from funding agencies in the public, commercial, or not-for-profit sectors.

**Conflict of interest:** YK, MT, MO, NK, and SI have positions with LEBER Inc. with salaries or consultation fees (outside of this work). MO and SI provided the database; however, they did not conduct the analysis or decide the direction of the manuscript. YK and MT conducted the analysis and drafted the manuscript at Fukushima Medical University.

## Acknowledgements

We would like to thank the medical doctors at Tsukuba University and all other medical doctors who greatly cooperated in the teleconsultation with LEBER users. We would also like to thank Yuka Harada and Kyoko Harada for their assistance in providing critical data for this study.

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