Age and Social Disparities in the Use of Telemedicine During the COVID-19 Pandemic in Japan: Cross-Sectional Study

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Abstract

Background: The use of telemedicine outpatient visits has increased dramatically during the coronavirus disease 2019 (COVID-19) pandemic in many countries. Although disparities in access to telemedicine by age and socio-economic status (SES) have been well-documented, evidence is limited as to how these disparities changed during the COVID-19 pandemic.

Objective: To investigate changes due to age and SES disparities in telemedicine use during the COVID-19 pandemic.

Methods: Using data from a large internet survey conducted between August 25 and September 30, 2020, in Japan, we examined the associations between participants' ages and SES (educational attainment, urbanicity of residence, and income level) and their telemedicine use in two time periods during the pandemic: April and August-September 2020.

Results: Of the 24,526 participants aged 18–79 years (50.8% [12,446] women), the proportion of individuals who reported using telemedicine increased from 2.0% (497) in April to 4.7% (1,159) in August-September 2020. After adjusting for potential confounders, younger individuals were more likely to use telemedicine than older individuals in April. Although this pattern persisted in August-September, we also observed a substantial increase in telemedicine use among individuals aged 70-79 years (adjusted rates, 0.2% in April vs. 3.8% in August-September; P<.001 after multiple comparisons). We found disparities by SES in the use of telemedicine in August-September that did not exist in April. In August-September, individuals with a university degree were more likely to use telemedicine than those with a high school diploma or less (6.6% vs. 3.5%; P<.001). Individuals living in urban areas exhibited higher rates of telemedicine use than those living in rural areas only in August-September (5.2% vs. 3.8%; P<.001). Disparities due to income level in telemedicine use were not observed in either time period.

Conclusions: In general, younger individuals increased their use of telemedicine compared to older individuals during the pandemic, although individuals in their 70s also increased their use of telemedicine. Disparities by educational attainment and urbanicity of residence in the use of telemedicine widened during the COVID-19 pandemic.

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ABSTRACT

Background: The use of telemedicine outpatient visits has increased dramatically during the coronavirus disease 2019 (COVID-19) pandemic in many countries. Although disparities in access to telemedicine by age and socio-economic status (SES) have been well-documented, evidence is limited as to how these disparities changed during the COVID-19 pandemic. Moreover, the equity of patient access to telemedicine has been scarcely reported in Japan, despite its huge potential for telemedicine expansion.

Objective: To investigate changes due to age and SES disparities in telemedicine use during the COVID-19 pandemic in Japan.

Methods: Using data from a large internet survey conducted between August 25 and September 30, 2020, in Japan, we examined the associations between participants' ages and SES (educational attainment, urbanicity of residence, and income level) and their telemedicine use in two time periods during the pandemic: April and August-September 2020.

Results: Of the 24,526 participants aged 18–79 years (50.8% (12,446] women), the proportion of individuals who reported using telemedicine increased from 2.0% (497) in April to 4.7% (1,159) in August-September 2020. After adjusting for potential confounders, younger individuals were more likely to use telemedicine than older individuals in April. Although this pattern persisted in August-September, we also observed a substantial increase in telemedicine use among individuals aged 70-79 years (adjusted rates, 0.2% in April vs. 3.8% in August-September; *P*<.001 after multiple comparisons). We found disparities by SES in the use of telemedicine in August-September that did not exist in April. In August-September, individuals with a university degree were more likely to use telemedicine than those with a high school diploma or less (6.6% vs. 3.5%; *P*<.001). Individuals living in urban areas exhibited higher rates of telemedicine use than those living in rural areas only in August-September (5.2% vs. 3.8%; $P<.001$). Disparities due to income level in telemedicine use were not observed in either time period.

Conclusions: In general, younger individuals increased their use of telemedicine compared to older individuals during the pandemic, although individuals in their 70s also increased their use of telemedicine. Disparities by educational attainment and urbanicity of residence in the use of telemedicine widened during the COVID-19 pandemic.

Keyword: Telemedicine; Telehealth; Disparity; Access to care; COVID-19; Japan

INTRODUCTION

The coronavirus disease 2019 (COVID-19) pandemic has led to a global public health crisis. More than 81 million cases have been reported worldwide as of the end of December 2020, with 1.8 million deaths from COVID-19 infection.[1] This pandemic has disrupted routine health services across countries—in-person outpatient visits have drastically decreased in the US[2,3] and Japan.[4] Telemedicine visits are partially replacing this decline in in-person visits[3,5] and allow for medical care at a safe social distance in many countries.[6] Changes in the regulations related to the use of telemedicine, including higher reimbursement rates and less restrictive security requirements (e.g., allowing non-HIPAA-compliant modalities such as Facetime and Skype) facilitated increases in telemedicine usage.[6,7]

Telemedicine has the potential to increase access to care for historically underserved populations who experience distance and transportation barriers to the more traditional face-to-face method of providing medical care.[8] Evidence suggests that telemedicine is effective for several types of medical interventions, including smoking cessation,[9] psychiatry care,[10,11] and management of chronic diseases, such as diabetes, heart disease, and chronic obstructive pulmonary disease.[12,13] Telemedicine can improve health outcomes even among older adults who face additional hurdles when using telemedicine due to sensory barriers and multiple comorbidities.[14] However, there have been concerns that the diffusion of telemedicine technology may have exacerbated social inequality in access to new healthcare technologies.[15] Racial/ethnic minorities, rural residents, and those with lower educational attainment have relatively limited access to information and communications technologies (ICTs),[16,17] and thus are less likely to take advantage of telemedicine. Older adults are also less prepared to use telemedicine than younger adults because of disabilities in hearing and speaking or inexperience with technology.[16,18]

Disparities in telemedicine access by age and socio-economic status (SES) have been well-documented during the COVID-19 pandemic. A study conducted at four clinics in San Francisco reported that the proportion of primary care visits with minority patients aged ≥65 years decreased after telemedicine implementation.[19] Other studies conducted in the US have found that telemedicine during COVID-19 was concentrated among younger individuals living in urban areas with higher SES.[20–23] Yet, these findings show disparities only at one point in the COVID-19 pandemic, and evidence is limited as to how disparities in telemedicine use by age and SES changed as the need for telemedicine persisted during the COVID-19 pandemic.

Moreover, there is limited research on the socio-demographic patterns in telemedicine use outside the US. Japan has the universal health coverage through the social insurance scheme, and is one of the countries that achieve the highest life expectancy in the world.[24] Japan has a lower number of telemedicine users compared to the US, Canada, and European countries.[25] Recently, mainly due to the impact of the COVID-19 pandemic, policymakers in Japan have been promoting the use of telemedicine. For example, the Japanese government approved the insurance coverage of telemedicine visits in 2018, and further promoted the use of telemedicine during the COVID-19 pandemic. Although the overall use of telemedicine has increased during the COVID-19 pandemic, given that it requires patients to be familiar with healthcare IT, it is possible that it had increased disparity gaps in the access to and use of telemedicine between certain subpopulations (e.g., the old vs. young populations). However, the equity of patient access to telemedicine has not been well-characterized in Japan.

To bridge this knowledge gap, we used data from a large internet survey conducted in Japan to examine how disparities in the use of telemedicine by age and SES may have changed during two time periods following the declaration of the pandemic: April and August-September 2020. According to the trend in confirmed COVID-19 cases reported in Japan, April corresponded to the early stage of the first wave of the COVID-19 epidemic (under the state of emergency), and August-September was during the second wave.[1] The aim of this study is to elucidate how disparities in the use of telemedicine due to age and SES have changed during the pandemic.

METHODS

Study Design, Setting, and Data Sources

We analyzed data from the *Japan "COVID-19 and Society" Internet Survey (JACSIS)* study,[26] a cross-sectional, web-based, self-reported questionnaire survey administered by a major nationwide internet research agency with 2.2 million qualified panelists.[27–29] Selected individuals aged 15-79 years (n=224,389) were included in the JACSIS study using stratified random sampling based on gender, age, and prefecture category to represent the distribution of the general population in Japan in 2019.[30,31] Individuals who agreed to participate in the survey accessed the designated website and responded to questionnaires asking about a wide range of socio-economic, lifestyle, and health measures in the context of the COVID-19 pandemic. Questionnaires were distributed from August 25, 2020, until September 30, 2020 (hereafter, "August-September"), when the pre-determined target number of participants for each gender, age, and prefecture category were met, with an overall response rate of 12.5% (28,000/224,389). For this study, we used a subsample of adults aged 18-79 years (n=27,641). We sequentially excluded 2,477 individuals showing unnatural or inconsistent responses using the algorithm we developed, and 638 individuals whose zip code information was missing. This study was approved by the University of Tokyo (No. 2020337NI).

Exposure Variables

The primary exposure variable was participants' age. The secondary exposure variables were SES measures of educational attainment, urbanicity of residence, and household income level. Age was categorized into six groups: 18-29 (reference), 30-39, 40-49, 50-59, 60-69, and 70-79 years. Educational attainment was categorized into three groups: those who had a university degree or higher (reference; corresponding to the *International Standard Classification of Education* [ISCED][32] level 6-8), a college degree (ISCED level 5; colleges include junior, community, and vocational colleges), and a high school diploma or lower (ISCED level 0-4). Urbanicity of residence was dichotomized (urban [reference] vs. rural). An urban area was defined as a densely inhabited district, which was determined according to the information from the 2015 Census of Japan linked to the 7-digit zip codes reported by the participants;[33] rural area was defined as a non-urban area. Income level was based on self-reported household income and categorized into four groups using the tertiles of household equivalent income ("high" = more than 4.3 million JPY [reference], "medium" = 2.5 to 4.3 million JPY, or "low" = less than 2.5 million JPY), and an indicator for those who refused to respond to this question.

Outcome Variables

Our outcome of interest was whether the participant used telemedicine, defined as the examination, diagnosis, and treatment of patients by physicians via information and communication devices that contain real-time visual and auditory information (according to the Ministry of Health, Labour, and Welfare of Japan).[34] The telemedicine use was measured at the two different time points during the COVID-19 pandemic in 2020: (1) April and (2) August-September (= at the time of the survey). We asked the participants, "Have you ever used telemedicine as a patient?" Participants were to select from one of three options: "(a) I have used it before April 2020," "(b) I used it for the first time after April 2020," or "(c) Never." We regarded the participants who chose (a) as using telemedicine as of April, and those who answered (a) or (b) as using telemedicine as of August-September. We defined the use of telemedicine as those individuals who ever used telemedicine, rather than using the frequency of telemedicine use as the outcome variable, because only survey participants with health issues that require a medical attention actually use telemedicine (even those individuals with access to telemedicine would not use telemedicine if they had no health issue during the study period). Moreover, the frequency of telemedicine was not only affected by patients' access to telemedicine, but also by several other factors including the severity of illness of patients and the physician's practice patterns (some physicians may see patients more often than others). The similar approach has been used in prior studies.[35,36]

Adjustment Variables

We adjusted for the participants' socio-demographic and health-related characteristics. The socio-demographic characteristics included employment status (employer, self-employed, employee, and unemployed), marital status (married, never married, widowed, and separated), and household size (number of household members: 1, 2, 3, 4, and 5+). Health-related characteristics included smoking status (never, ever, and current smokers), self-rated health (excellent/good vs. moderate/bad/very bad), walking disability (whether the person is experiencing difficulties in walking), and dummy variables for each of nine comorbidities (overweight [body mass index ≥ 25 kg/m2] and self-reported presence of eight conditions including hypertension, diabetes, asthma, coronary disease, stroke, chronic obstructive pulmonary disease, cancer, and psychological disorder). Body mass index was calculated by dividing self-reported body weight by self-reported body height squared (m^2).

Statistical Analysis

First, we described the socio-demographic and health-related characteristics of the participants. To account for the possibility that those who participated and responded to the internet-based survey might differ from the general population, we applied an inverse probability weighting (IPW) approach throughout the analyses.[37] The details of the calculation for IPW are described in **Method S1** in **Multimedia Appendix 1**.

Second, we examined the association between age and rates of telemedicine use in April or August-September, respectively. For each outcome, we constructed a weighted multivariable logistic regression model (IPW described above) that controlled for potential confounders (the other exposures [i.e., educational attainment, urbanicity of residence, and income level] and socio-demographic/health-related characteristics). Standard errors were clustered at the prefecture-level to account for the potential correlation of participants within the same prefecture. (Japan consists of 47 prefectures, which are the country's first jurisdiction and administrative division levels.) To calculate adjusted rates of telemedicine use, we employed marginal standardization (also known as predictive margins or margins of response). For each participant, we calculated predicted probabilities of telemedicine use with the exposure fixed at each category and then averaged over the distribution of the adjustment variables in our sample.

Third, to examine the adjusted change in telemedicine use from April to August-September, we calculated the difference in the adjusted rates of telemedicine use between these two time points for each age group.

Finally, we tested if the adjusted changes in telemedicine use from April to August-September varied across age, by calculating the difference-in-differences. We also used a similar approach to examine the adjusted rates of telemedicine use and their changes by each SES aspect (educational attainment, urbanicity of residence, and income level).

We used the Benjamini-Hochberg method to account for the multiple comparisons across 6+3+2+4=15 exposure categories (5+2+1+3=11 categories for the difference in the adjusted differences), and reported both unadjusted and adjusted P values (adjusted P values < .05 were considered as statistically significant).[38,39] All analyses were conducted using Stata version 15 (College Station, TX; StataCorp LLC.).

Secondary Analyses

We conducted sensitivity analyses. First, we additionally adjusted for indicator variables for each prefecture (prefecture fixed effects) to effectively compare individuals living in the same prefecture. Second, we additionally adjusted for four categorical variables representing availability of ICTs—including internet access at home and ownership of personal computers, smartphones, and tablet computers—to test whether online access could explain the observed disparities by age and SES in rates of telemedicine use.

RESULTS

Characteristics of Participants

A total of 24,526 participants (88.7% of the total adult subsample) were included in our analyses. There were 12,446 women (50.8%), and the mean (SD) age at the time of the survey was 50.1 (16.6) years. Those who had a high school diploma or less were the most numerous, accounting for half of the participants, while one-third of the participants had a university degree or higher, and less than 20% had a college degree. Approximately 60% of the participants lived in urban areas (**Table 1**).

Table 1. Characteristics of participants.[a-d]

Characteristics		Total (N=24,526)
Female		12,446 (50.8)
Age, year, mean (SD)		50.1 (16.6)
Educational attainment	University degree or higher	7,915 (32.3)
	College degree	4,581 (18.7)
	High school diploma or lower	12,030 (49.1)
Urbanicity of residence	Urban	14,666 (59.8)
	Rural	9,560 (40.2)
Income level	High	5,458 (22.3)
	Medium	6,814 (27.8)
	Low	7,151 (29.2)
	Not answered	5,103 (20.8)
Employment status	Employer	1,011 (4.1)
	Self-employed	1,892 (7.7)
	Employee	12,623 (51.5)
	Unemployed	9,000 (36.7)
Marital status	Married	16,102 (65.7)
	Never married	5,413 (22.1)
	Widowed	1,606 (6.6)
	Separated	1,403 (5.7)
Household size	1	4,152 (16.9)
	2	8,386 (34.2)
	3	5,547 (22.6)
	4	4,124 (16.8)
	5+	2,317 (9.5)
Smoking status	Never	12,186 (49.7)
	Ever	7,423 (30.3)
	Current	4,917 (20.0)
Self-rated good health		9,839 (40.1)
Walking disability		3,142 (12.8)
Comorbidities	Overweight	5,202 (21.2)
	Hypertension	5,086 (20.7)
	Diabetes	1,911 (7.8)
	Asthma	1,450 (5.9)
	Coronary disease	923 (3.8)
	Stroke	459 (1.9)
	COPD	332 (1.4)
	Cancer	774 (3.2)
	Psychological disorder	1,848 (7.5)

[a]SD: standard deviation.
[b]The numbers are No. (%), except for age.
[c]Colleges include junior, community, and vocational colleges.
[d]Self-rated good health was defined as very good or good using the 5-point Likert scale question, which asked if self-rated health status was very good, good, moderate, bad, or very bad.

Overall Trend in Rates of Telemedicine Use

Of the 24,526 participants aged 18–79 years (50.8% (n=12,446) women), the proportion of individuals who reported using telemedicine increased from 2.0% (n=497) in April to 4.7% (n=1,159) in August-September 2020.

Adjusted Rates of Telemedicine Use by Age

After adjusting for potential confounders, younger individuals were more likely to use telemedicine than older individuals in April (**Figure 1** and **Table S1** in **Multimedia Appendix 1**). Although this pattern remained largely unchanged in August-September, with participants aged 18-29 years exhibiting the largest increase in telemedicine use (adjusted rates, 4.3% in April vs. 10.2% in August-September; adjusted difference, +5.8 percentage points [pp]; adjusted *P* value<.001), we also observed a substantial increase in telemedicine use among participants aged 70-79 years (from 0.2% to 3.8%; +3.5 pp; *P*<.001) (**Table 2**). The increase in the adjusted rates of telemedicine use among participants aged 18-29 years was 3.5 pp larger compared to those aged 40-49 years (*P*=.04), 3.9 pp larger compared to those aged 50-59 years (*P*=.01), and 4.5 pp larger compared to those aged 60-69 years (*P*=.003). However, we found no evidence that the increase in the rates of telemedicine use differed between those aged 18-29 years and 70-79 years (*P*=.19).

Age Group (years)	No. of participants	Adjusted rate, % (95% CI)		Difference, (2)-(1), % (95% CI)	*P* value	Difference-in-differences (95% CI)	*P* value
		(1) April	(2) August-September				
18-29	3,388	4.3	10.2	5.8 (3.0, 8.7)	<.001	Reference	
30-39	3,784	3.0	6.3	3.3 (1.7, 4.9)	<.001	-2.5 (-5.8, 0.7)	.19
40-49	4,883	1.8	4.1	2.3 (1.2, 3.3)	<.001	-3.5 (-6.6, -0.5)	.04
50-59	4,278	1.2	3.2	2.0 (0.9, 3.1)	<.001	-3.9 (-6.9, -0.8)	.01
60-69	4,286	0.8	2.2	1.4 (0.4, 2.4)	.004	-4.5 (-7.5, -1.4)	.003
70-79	3,907	0.2	3.8	3.5 (2.2, 4.8)	<.001	-2.3 (-5.5, 0.8)	.19

Table 2. Difference in adjusted rates of telemedicine use between April and August-September, by age.[a-c]

[a]CI: confidence interval.

[b]We calculated the differences in the adjusted rates of telemedicine use between (1) April and (2) August-September for each age group. Then, we examined how the difference in the rates of telemedicine use between the two time points varied by age (difference-in-differences). The analyses were weighted to account for selection in an internet survey. For each analysis, standard errors were clustered at the prefecture-level.

[c]The *P* values were adjusted post hoc to account for multiple comparisons with the use of the Benjamini-Hochberg method.

Adjusted Rates of Telemedicine Use by SES Measures

Educational Attainment

We found no evidence that the adjusted rates of telemedicine use differed by educational attainment in April (**Figure 2**). In contrast, we found disparities by SES in the use of telemedicine in August-September. Participants with a university degree or higher were more likely to use telemedicine than those with a college degree (6.6% vs. 4.0%; *P*=.006) or high school diploma or less (6.6% vs. 3.5%; *P*<.001) (**Table S1** in **Multimedia Appendix 1**). The increase in the adjusted rates of telemedicine use among participants with a university degree or higher was 2.2 pp larger compared to those with a college degree (*P*=.01) and 2.7 pp larger compared to those with a high school diploma or less (*P*=.003) (**Table 3**).

Urbanicity of Residence

We found no evidence that the adjusted rates of telemedicine use differed by urbanicity of residence in April (**Figure 2**). Participants living in urban areas exhibited higher rates of telemedicine use than those living in rural areas only in August-September (5.2% vs. 3.8%; *P*<.001) (**Table S1** in **Multimedia Appendix 1**). The increase in the adjusted rates of telemedicine use among participants living in urban areas was 1.4 pp higher compared to those living in rural areas (*P*=.004) (**Table 3**).

Income Level

We found no evidence that the adjusted rates of telemedicine use differed by income level in

April or August-September (**Figure 2**). We also found no evidence that the increases in the rates of telemedicine use varied by income level (**Table 3**).

Table 3. Difference in adjusted rates of telemedicine use between April and August-September, by socio-economic status measures.[a-c]

	No. of participants	Adjusted rate, % (95% CI)		Difference, (2)-(1), % (95% CI)	*P* value	Difference-in-differences (95% CI)	*P* value
		(1) April	(2) August-September				
Educational Attainment							
University or higher	7,915	2.3	6.6	4.3 (2.7, 5.9)	<.001	Reference	
College	4,581	1.9	4.0	2.1 (1.3, 2.9)	<.001	-2.2 (-4.0, -0.4)	.01
High school or lower	12,030	1.9	3.5	1.6 (0.9, 2.4)	<.001	-2.7 (-4.4, -0.9)	.003
Urbanicity of Residence							
Urban	14,666	2.1	5.2	3.2 (2.4, 3.9)	<.001	Reference	
Rural	9,860	2.0	3.8	1.8 (1.2, 2.4)	<.001	-1.4 (-2.3, -0.4)	.004
Income Level							
High	5,458	1.7	4.6	2.8 (1.8, 3.8)	<.001	Reference	
Medium	6,814	1.9	4.7	2.8 (1.5, 4.2)	<.001	0 (-1.6, 1.7)	.99
Low	7,151	2.3	4.4	2.1 (1.3, 2.9)	<.001	-0.7 (-2.0, 0.6)	.34
Not answered	5,103	2.1	5.4	3.2 (1.1, 5.4)	.003	0.4 (-2.0, 2.8)	.79

[a]CI: confidence interval.

[b]We calculated the differences in the adjusted rates of telemedicine use between (1) April and (2) August-September for each socio-economic status measure (educational attainment, urbanicity of residence, or income level). Then, we examined how the difference in the rates of telemedicine use between the two time points varied by educational attainment, urbanicity of residence, or income level (difference-in-differences). The analyses were weighted to account for selection in an internet survey. For each analysis, standard errors were clustered at the prefecture-level.

[c]The *P* values were adjusted post hoc to account for multiple comparisons with the use of the Benjamini-Hochberg method.

Secondary Analyses

Our findings were qualitatively unaffected by additional adjustment for prefecture fixed effects (**Table S2** in **Multimedia Appendix 1**). When we additionally adjusted for the variables representing the availability of ICTs, our findings of increased disparities by SES (i.e., university or higher vs. high school or lower and urban vs. rural) were largely unaffected (**Table S3** in **Multimedia Appendix 1**). However, we no longer found any evidence that the increase in the rates of telemedicine use varied between young individuals (aged 18-29 years) and middle-aged individuals (aged 40-49, 50-59, or 60-69 years), indicating that the trends of the disparities due to age in telemedicine use were partly driven by differences in online access.

DISCUSSION

Principal Results

Using data from a large nationwide internet survey conducted in Japan, we found that younger individuals increased the use of telemedicine more than older individuals (leading to wider disparities by age groups) during the COVID-19 pandemic, although individuals in their 70s also increased the use of telemedicine. Disparities by educational attainment and urbanicity of residence in telemedicine use also increased during the pandemic, whereas we found no evidence that disparities by income level changed.

Younger people were already more likely to use telemedicine as of April 2020; this disparity by age further increased as of August-September 2020 among adults aged 69 years or younger.

However, telemedicine use also increased among older adults aged 70-79 years, narrowing the gap in telemedicine use among this population. In April, there was no evidence that telemedicine use varied across educational attainment and urbanicity of residence, but by August-September, better educated individuals living in urban areas were more likely to use telemedicine. In contrast, we did not find significant disparities by income level in either April or August-September. Taken together, these findings suggest that improved access to telemedicine during the pandemic may have penetrated unevenly in the population, leaving behind some socio-economically disadvantaged populations. In contrast, the growing use of telemedicine among older adults was reassuring, indicating that this population—who have high healthcare needs but are often unfamiliar with ICTs[16]—benefitted from improved access to telemedicine.

There may be several mechanisms through which the disparities in telemedicine use due to age have widened, especially among individuals aged 69 years or younger. First, younger people may have been more familiar with ICTs, and therefore, faced lower psychological or technological hurdles to initiating telemedicine usage when access to it improved in response to the COVID-19 pandemic in Japan.[16] This explanation is supported by our findings showing no evidence of disparities due to age in telemedicine use once we adjusted for the indicators of ICT availability. Second, the healthcare needs of young patients may be milder than those of older patients, making young patients more suited to the use of telemedicine. For example, young patients may have fewer comorbidities and seek care for milder conditions compared to middle-aged or older adults. Young patients also may be less likely to need blood tests or diagnostic imaging, which require patients to physically visit a healthcare facility.[40,41] Finally, younger individuals may be less likely to have disabilities and sensory barriers that could be hurdles to telemedicine use.

[14]

We also found that individuals aged 70-79 years experienced a large increase in telemedicine use. Given that these older adults are in the highest-risk age group for COVID-19 infection (most likely to experience severe, life-threatening conditions when infected),[42] they might be incentivized to use telemedicine to avoid visiting healthcare facilities, which might lead to COVID-19 infection.

The limited increase in telemedicine use for individuals with lower academic attainment may be due to their lower digital literacy, limited access to ICTs, and less flexible work schedules,[43] all of which could be barriers to using telemedicine.[16] The limited penetration of telemedicine use in rural areas may be explained by inadequate internet access in rural areas[16] and the fact that there were fewer medical institutions offering telemedicine in rural areas.[44] Given that the number of COVID-19 infections was generally higher in urban areas compared with rural areas, another potential explanation for the relative expansion in telemedicine use in urban areas may be that patients living in urban areas were more incentivized to avoid face-to-face encounters. However, we found that the inclusion of prefecture fixed effects (effectively comparing urban vs. rural areas within the same prefecture) did not qualitatively change our results, indicating that this does not fully explain the disparities in telemedicine use between residents of urban vs. rural areas. It was reassuring that we found no substantial disparities by income level in access to telemedicine throughout the study period. Our findings may indicate that, at least in Japan, financial barriers have minimally influenced the disparities in telemedicine use.

Comparison with Prior Work

Our findings add to a body of work investigating the impact of age and SES on telemedicine use during the COVID-19 pandemic. Studies that were conducted prior to the expansion of telemedicine use in response to the COVID-19 pandemic have reported that younger patients were more likely to use telemedicine, whereas these studies showed mixed results regarding the disparities by area income level and urbanicity of residence. Studies that were conducted after the COVID-19 pandemic found that telemedicine use overall[41,49,50] and for geriatric care,[21] primary care,[19,22,51] or otolaryngological care[23] was concentrated among younger individuals living in urban, high-income areas. Yet, the timeframe used in these studies represented only one early point in the COVID-19 pandemic, and did not focus on the change over time for age and social disparities in telemedicine use. These previous studies used area income level as an indicator of income level, as opposed to individual income level used in our research. The inconsistent results for income level may partly be attributable to this difference. More importantly, to our knowledge, our study is the first to show that telemedicine use increased substantially among individuals aged 70 years and older, reducing telemedicine disparities among the population at highest-risk for COVID-19 infection.

Limitations

Our study has limitations. First, as with any observational study, we could not fully account for unmeasured confounders. Our study also was unable to identify the exact mechanisms of the association between age or SES and the increase in rates of telemedicine use. Second, due to a limitation in our data, we were unable to identify whether telemedicine use represented telephone visits or virtual visits. Third, there is potential for recall bias; younger, higher SES individuals might be more likely to recall and report telemedicine use. Fourth, we could not identify the clinical conditions for which patients received care via telemedicine. The reports submitted to the government by medical institutions offering telemedicine indicated that the most common conditions for which patients used telemedicine between July and September 2020 were acute, relatively mild conditions, such as upper respiratory tract infection, fever, bronchitis, and rhinitis.[44] However, evidence suggests that telemedicine is suitable for psychiatric care[10,11] and management of chronic conditions.[12,13] This gap may be due to patients avoiding clinic visits with signs of infection and shifting to telemedicine or the Japanese authorities' restriction on the prescription of psychiatric drugs in telemedicine.[44] The patterns of telemedicine use by age and SES may change as the profiles of conditions treated via telemedicine increase in the future. Finally, because our study sample was collected through an internet-based survey, our findings may not be generalizable to a population with limited access to and/or literacy of the internet. However, we used weighted analyses to minimize the difference in demographics, SES, and health-related characteristics between respondents to the current internet survey and the nationally representative survey, thus approximating our estimates to national estimates.

Conclusions

Using a large-scale, nationwide internet survey in Japan, we found that younger individuals were generally more likely to increase telemedicine use than older individuals during the pandemic, although individuals in their 70s exceptionally gained access to telemedicine. Disparities by educational attainment and urbanicity of residence in the use of telemedicine increased during the COVID-19 pandemic. These findings indicate that the current telemedicine expansion may be leaving a portion of the socio-economically disadvantaged population behind, and suggest further need for policy efforts to achieve equal access to healthcare.

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Author Contributions

Dr. Miyawaki had full access to the data in the study and takes responsibility for the accuracy and integrity of the data and its analyses.

Study concept and design: All authors.

Acquisition, analysis, or interpretation of data: All authors.

Drafting of the manuscript: Miyawaki and Tsugawa.

Critical revision of the manuscript for important intellectual content: All authors.

Statistical analysis: Miyawaki, Tabuchi, and Tsugawa.

Administrative, technical, or material support: Tsugawa.

Study supervision: Tsugawa.

Conflicts of Interest

The authors have declared that no competing interests exist.

Abbreviations

COVID-19: coronavirus disease 2019

HIPAA: Health Insurance Portability and Accountability Act

ICT: information and communications technology

IPW: inverse probability weighting

ISCED: International Standard Classification of Education

JACSIS: Japan “COVID-19 and Society” Internet Survey

JPY: Japanese yen

SD: standard error

SES: socio-economic status

US: United States

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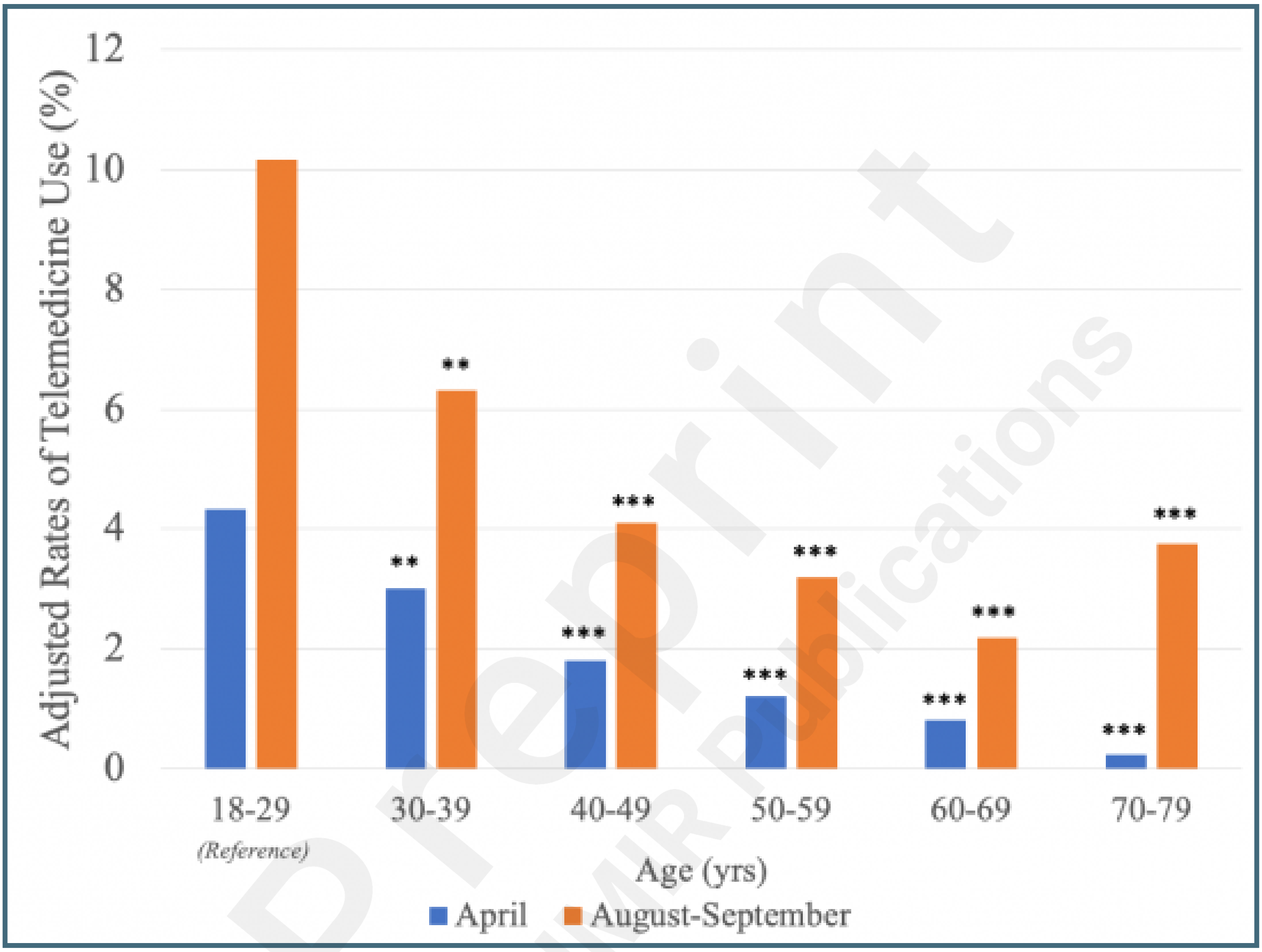
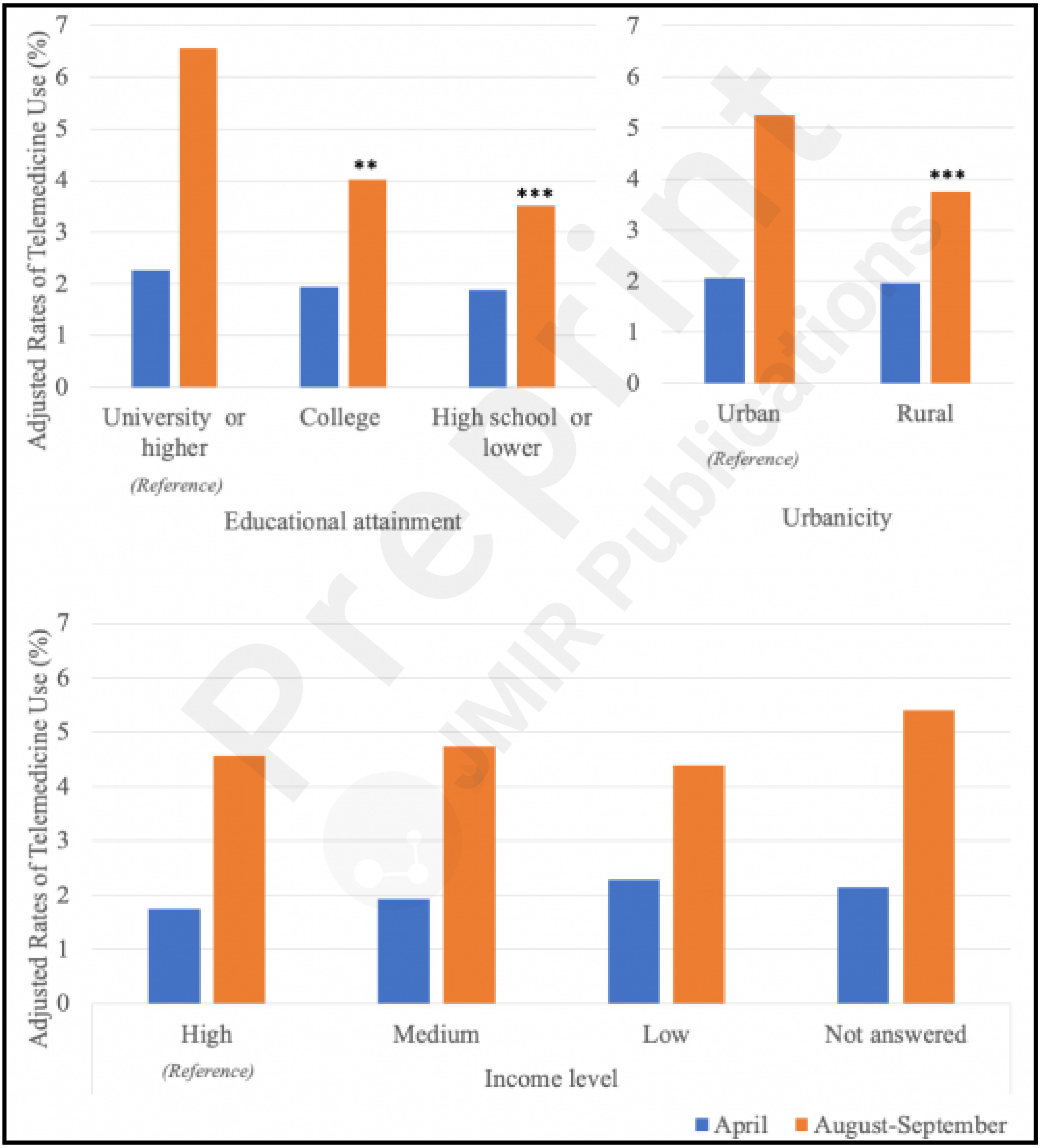
Supplementary Files

Figures



Adjusted Rates of Telemedicine Use (%)
12
10
8
6
4
2
0
**
**
***
***
***
***
***
***
***
***
18-29
(Reference)
30-39
40-49
50-59
60-69
70-79
Age (yrs)
April
August-September


Adjusted Rates of Telemedicine Use (%)
7
6
5
4
3
2
1
0
**
***
University or higher
(Reference)
College
High school or lower
Educational attainment
***
Urban
(Reference)
Rural
Urbanicity
Adjusted Rates of Telemedicine Use (%)
High
(Reference)
Medium
Low
Not answered
Income level
April
August-September

Multimedia Appendixes

Method S1, Table S1, Table S2, and Table S3.

URL: http://asset.jmir.pub/assets/91580871c7fa20e10dde23ffb7232a0b.docx

CONSORT (or other) checklists

STROBE checklist.

URL: http://asset.jmir.pub/assets/13b46c65ff5fa51e94550d8dd1b11e09.pdf