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The paradox of the COVID-19 pandemic: The impact on patient demand in Japanese hospitals

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ABSTRACT

Analyzing data from a large, nationally distributed group of Japanese hospitals, we found a dramatic decline in both inpatient and outpatient volumes over the three waves of the COVID-19 pandemic in Japan from February to December 2020. We identified three key reasons for this fall in patient demand. First, COVID-19-related hygiene measures and behavioral changes significantly reduced non-COVID-19 infectious diseases. Second, consultations relating to chronic diseases fell sharply. Third, certain medical investigations and interventions were postponed or cancelled. Despite the drop in hospital attendances and admissions, COVID-19 is said to have brought the Japanese health care system to the brink of collapse. In this context, we explore longstanding systematic issues, finding that Japan's abundant supply of beds and current payment system may have introduced a perverse incentive to overprovide services, creating a mismatch between patient needs and supply of health care resources. Poor coordination among medical providers and the highly decentralized governance of the health care system have also contributed to the crisis. In order to ensure the long-term sustainability of the Japanese health care system beyond COVID-19, it is essential to promote specialization and differentiation of medical functions among hospitals, to strengthen governance, and to introduce appropriate payment reform.

1. Introduction

The coronavirus disease 2019 (COVID-19) pandemic has had far-reaching impacts on health care services around the globe, and Japan is no exception. While Japan is exceptionally rich in medical resources (it has, per capita, the largest number of hospital beds among the OECD countries, and the most CT and MRI scanners in the world [1]), the medical care system has often been described by experts as being on the brink of collapse, with the president of the Japan Medical Association pointing to a severe shortage of doctors and nurses [2], and near-daily reporting in the media about a lack of hospital bed capacity [3].

In many respects, such observations are unsurprising. After all, one of the highest risk groups for contracting severe COVID-19 is older people, and Japan has one of the world's most elderly populations, with nearly a third of its inhabitants (some 36 million people) over the age of 65 [4]. Furthermore, transmission through close human contact is known to be a significant factor in spreading the disease, and the Greater Tokyo Area is the most populous metropolitan area in the world, with the Tokyo Metropolis alone home to nearly 14 million people. In these circumstances, Japan has been very fortunate to record considerably

lower morbidity and mortality rates than those recorded in Europe and the US. For example, as of April 1, 2021, Japan's COVID-19 morbidity rate (confirmed cases per million people) was 3,833.41, an order of magnitude lower than those rates registered at that time in the United Kingdom (64,718.28), the United States (90,919.04), and Germany (33,967.42) [5]. Japan's COVID-19 mortality rate (cumulative COVID-19-related deaths per million people) was 73.78 as of April 1, 2021, whereas the United Kingdom, the United States, and Germany registered rates of 1,885.38, 1,630.22, and 917.69, respectively [5].

However, while COVID-19 has certainly strained aspects of the Japanese health care system, is it true to say that it is at the brink of collapse? Looking at overall patient demand at Japanese hospitals during the pandemic reveals a complicated and rather paradoxical picture.

The first wave of the COVID-19 pandemic led to a decline in demand for hospital services in Japan [6]. A similar phenomenon was also seen in the United States, where the use of health care services dropped sharply with the onset of the pandemic [7,8]. Using recent data from a large, nationally distributed group of hospitals, our study will show that patient demand in Japanese hospitals, measured by outpatient attendances (hereafter referred to as 'visits') and inpatient admissions,

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unrelated to COVID-19, continued to plummet over the course of the first, second, and third waves of the pandemic, up to the end of 2020.

Up to now, little was known about the differences in hospital admission and visit patterns before and during the pandemic in Japan. A better understanding of the impact of COVID-19 on patient demand over time, and of the reasons why the health care system has come to the point of collapse despite experiencing a dramatic fall in patient demand, will provide insights to health system planners, policy makers, and clinicians seeking to secure the system's long-term sustainability.

2. Background to the pandemic in Japan

On January 15, 2020, a Chinese national was the first person to be confirmed to be infected with COVID-19 in Japan, having returned from Wuhan, Hubei Province, China [9]. At the beginning of February, a small number of positive COVID-19 cases were confirmed among passengers on board the Diamond Princess, a cruise ship anchored off the coast of Yokohama, Japan. The Japanese media reported on the situation continually, and there was widespread fear among the Japanese public about the potential impact of allowing the passengers and crew to disembark onto Japanese soil. By late March, it was found that 712 people aboard the ship had been infected by the disease.

In the meantime, community-acquired infections were gradually increasing, reaching a daily national total of over 300 new cases at the beginning of April, marking the 'first wave'. At this point, the Japan Surgical Society released its recommendation to postpone all elective surgery [10]. A week later, on April 7, 2020, the Japanese government responded to the increasing case numbers by declaring the first state of emergency. This initially covered the capital and six other prefectures, before being extended to cover the entire country on April 16, 2020. The number of reported daily infections fell below 100 in May, but then increased once again, surpassing 1000 for the first time in late July as a 'second wave', and then surging once more in November, marking a 'third wave'.

On January 8, 2021, a record daily high of 7,882 cases was announced, and the government declared a second state of emergency.

3. Materials and methods

3.1. Data

Japan has a universal health coverage system, but operates without a gatekeeping function, thereby granting patients free choice over which hospital to attend, even for minor illnesses. Hospitals and clinics therefore frequently provide both primary and more specialized care. The hospitals in our data set are all acute care hospitals accepting urgent inpatient admissions, but they also provide non-emergency (elective) inpatient care, as well as outpatient care for chronic diseases and minor illnesses.

There are several payment systems for medical services in Japan, which are based on the type of institution and the nature of the care provided. All clinics, and 79% of hospitals, are reimbursed solely on a fee-for-service basis, for both inpatients and outpatients. The remaining 21% of hospitals are funded by fee-for-service for outpatients, and a combination of fee-for-service and per-diem payments for inpatients, based on the 'Diagnosis Procedure Combination/Per-Diem Payment System' (DPC/PDPS). Unlike most other developed countries, which use payment methodologies based on a fixed fee per hospitalization (such as the 'Diagnosis Related Groups/Prospective Payment System', or DRG/PPS), the Japanese DPC/PDPS methodology creates a situation where hospitals are incentivized to keep patients hospitalized for longer. In 2020, there were a total of 1757 acute care hospitals using DPC/PDPS as part of their payment methodology, accounting for 54% of all general inpatient beds (483,180 beds) [11,12].

Our analysis was based on a sample of 454 hospitals that use DPC/PDPS. The data set, which comprises continuous data from February

2019 to December 2020, was obtained from Global Health Consulting Japan (GHC), a health care consultancy that provides benchmarking services to over 800 DPC/PDPS hospitals. Our data set includes inpatient data for all 454 hospitals, and outpatient data for 301 of the 454 hospitals.

Our sample size for outpatients was 40,342,799 visits in 2020, and 44,896,434 visits in 2019. For inpatients it was 3,245,279 admissions in 2020, and 3,578,056 admissions in 2019. Further details are provided in the Appendix.

The data contain discharge summaries that include patient characteristics such as age and sex, as well as each patient's reason for admission and primary diagnosis. The DPC/PDPS data also include the top two medically resource-intensive diagnoses, and up to ten complications and comorbidities, all listed under ICD-10 disease classification codes. The data contain information such as the hospital's ownership model (private, public, prefectural/municipal), hospital revenue figures, and information on all medical services and medications provided, for both inpatients and outpatients.

3.2. Measures

Our outcome measures were non-COVID-19 outpatient visits and inpatient admissions, by month. Outpatient visits include first visits and revisits, and inpatient admissions include both elective and urgent hospitalizations.

To adjust for fluctuations in disease incidence owing to seasonality, we calculated the year-on-year comparison of the monthly sum of disease-specific outpatient visits and inpatient admissions.

For outpatients, diagnoses were defined according to the ICD-10 codes recorded in the primary diagnosis field in the physician's admission billing claim. For inpatients, we used the most medical resource-intensive diagnoses.

3.3. Analysis

We use inferences about the difference between two population values for matched samples. The matched samples are designed to test the difference between two years (2019 and 2020) under the same conditions (i.e., for the same hospitals), thereby eliminating variation between hospitals (see Appendix E for more details). The overall study period is February–December 2020, with the same February–December period in 2019 used for the matched sample analysis.

We divided the study period into 6 further defined periods: the initial phase (February–March 2020), first wave (April–May 2020), post-first wave (June–July 2020), second wave (August 2020), post-second wave (September–October 2020), and third wave (November–December 2020). Our definition of the first wave corresponds with the period of the first state of emergency, from the beginning of April to the end of May. We defined the second wave as the whole month of August because the national total number of daily infections (positive test results) reached 1000 for the first time in late July. We defined the third wave as the months of November and December because infections started surging again in November.

3.4. Limitations

Psychiatric admissions were excluded from our data set because psychiatric hospitals are reimbursed under a purely fee-for-service system rather than the DPC/PDPS methodology, although patients in general beds at DPC/PDPS acute care hospitals whose condition has been diagnosed to include a mental illness do form part of the data set. The exclusion of the majority of psychiatric admissions from the data set is unfortunate because, prior to the first wave, Japan already trailed most OECD countries in the 'deinstitutionalization trend' towards community mental health care [13], and with the WHO highlighting the escalating demand for mental health services worldwide [14], mental health admissions are a crucial indicator of health care system

performance during COVID-19.

Furthermore, we did not analyze mortality because Japan’s mortality rate from COVID-19 is very low, despite its aging society. The number of deaths of people aged 65 and over due to pneumonia and influenza dropped sharply compared with the same period in 2019. Cardiovascular deaths also plummeted. However, the long-term physical and mental effects on the elderly resulting from the ‘stay home’ element of the COVID-19 emergency declarations will need to be analyzed separately.

4. Results

Table 1 shows the total number of diagnosis-specific outpatient first visits for 2019 and 2020 for the top 20 most common diagnoses, listed in descending order of the total visits in 2019. It also shows the percentage change in visits recorded for each diagnosis over the six study periods in 2020, relative to the same period in 2019.

Across the whole study period, there was a sharp decrease in outpatient visits for nearly all medical conditions. The largest decreases during the first wave were among diagnoses of acute upper respiratory infection (-64.5%, $p < 0.001$), acute bronchitis (-66.2%, $p < 0.001$), bronchial asthma (-59.4%, $p < 0.001$), and acute gastroenteritis (-75.1%, $p < 0.001$), and this trend continued for the rest of the year. Test results are shown in full in Table A1. The use of masks, hand-washing, and/or social distancing that became routine in response to the COVID-19 pandemic was probably effective in dramatically reducing such cases.

Diabetes and hypertension were also common reasons to make a first visit to an acute care hospital. While outpatient visits for these conditions showed a drastic decline in the first wave (diabetes -36.9%, $p <$

0.001; hypertension -31.0%, $p < 0.001$), there was a much less marked decline in subsequent periods. However, overall, we can observe a clear downward trend in outpatient first visits. These changes are statistically very significant, as shown in Table A1.

Table 2 presents the total number of diagnosis-specific outpatient revisits in 2019 and 2020 for the top 20 most common diagnoses, similarly listed in descending order, and alongside the percentage change for each of the six study periods relative to the same period in 2019. Chronic diseases such as hypertension, chronic kidney disease, and diabetes were the most common reasons to revisit acute care hospitals for outpatient care.

During the first wave, consultations relating to chronic diseases decreased, such as for hypertension (-13.5%, $p < 0.001$) and diabetes (-14.9%, $p < 0.001$). Test results are presented in Table B1. Many patients seem to have chosen to self-medicate or to consult doctors less frequently, or had their use of non-critical medical services intentionally curtailed by hospitals. The typical falls in revisits of 10% to 20% were not as drastic as those for first visits (Table 1), but the number of outpatient revisits was so large that the impact on the total outpatients and on hospital revenue was also very large.

Regarding inpatient admissions, Table 3 shows the total number of diagnosis-specific urgent hospital admissions for 2019 and 2020 for the top 20 most common diagnoses, listed in descending order of the total admissions in 2019. In Japan, pneumonia, cerebral infarction, heart failure, and aspiration pneumonia are the top four reasons for urgent hospital admission at acute care hospitals. Table 3 shows that during the COVID-19 pandemic, admissions for all four of the top diagnoses decreased overall. Test results are presented in Table C1.

Among the top 20 diagnoses, pneumonia, acute bronchitis, influenza and viral pneumonia, and viral enterocolitis are non-COVID-19

Table 1
Outpatient first visits for most common diagnoses in a sample of Japanese hospitals during 2019 and 2020, and percentage change from 2019, by period.

Diagnosis	Total number of outpatient first visits, Feb–Dec 2019	Total number of outpatient first visits, Feb–Dec 2020	Total percentage change (from 2019)	Percentage change by period in 2020 (compared with 2019)					
				Initial Phase (Feb–Mar)	First Wave (Apr–May)	Post-First Wave (Jun–Jul)	Second Wave (Aug)	Post-Second Wave (Sep–Oct)	Third Wave (Nov–Dec)
TOTAL (All diagnoses)	4,373,665	3,368,468	-22.98%	-16.7%	-44.8%	-22.5%	-19.4%	-12.9%	-19.1%
J069 Acute upper respiratory infection	161,358	81,667	-49.39%	-16.9%	-64.5%	-54.6%	-50.4%	-52.5%	-56.3%
E11 Type 2 diabetes mellitus	90,023	76,123	-15.44%	-11.2%	-36.9%	-15.5%	-13.0%	-4.0%	-10.7%
I10 Hypertension	75,716	65,305	-13.75%	-7.1%	-31.0%	-14.5%	-13.9%	-1.3%	-13.8%
J209 Acute bronchitis	72,548	32,502	-55.20%	-17.1%	-66.2%	-63.8%	-61.4%	-60.0%	-62.6%
J459 Bronchial asthma	55,799	29,657	-46.85%	-21.7%	-59.4%	-51.4%	-54.4%	-46.5%	-48.5%
A099 Acute gastroenteritis	53,943	26,426	-51.01%	-23.9%	-75.1%	-53.6%	-44.5%	-44.3%	-55.6%
C189 Colorectal cancer	48,619	39,739	-18.26%	-12.3%	-46.6%	-28.2%	-22.3%	-2.2%	-6.6%
R51 Headache cephalalgia	48,503	35,246	-27.33%	-22.9%	-43.9%	-23.5%	-20.4%	-22.0%	-29.1%
I639 Cerebral infarction	43,128	34,258	-20.57%	-16.2%	-43.2%	-16.0%	-17.7%	-9.2%	-19.7%
E86 Prolapse prolapsus	41,152	33,792	-17.88%	-7.9%	-35.6%	-21.8%	-8.8%	-12.7%	-17.4%
I209 Angina pectoris	39,942	32,408	-18.86%	-14.8%	-36.4%	-22.7%	-11.8%	-3.6%	-19.5%
M4806 Lumbar spinal canal stenosis	39,704	32,443	-18.29%	-14.4%	-45.5%	-11.7%	-17.0%	-4.5%	-13.9%
R509 Fever pyrexia	39,210	41,266	5.24%	-3.4%	-16.9%	4.0%	30.5%	21.5%	6.6%
K635 Colonic polyp	38,901	31,491	-19.05%	-10.5%	-52.6%	-25.7%	-22.8%	0.5%	-9.6%
C349 Lung cancer	38,460	31,354	-18.48%	-9.5%	-38.3%	-25.4%	-20.3%	-5.7%	-14.6%
K590 Constipation	37,335	26,754	-28.34%	-22.7%	-43.6%	-24.9%	-26.2%	-22.4%	-28.9%
S000 Head bruises	35,508	28,201	-20.58%	-15.0%	-44.7%	-21.1%	-11.6%	-9.1%	-15.0%
J304 Allergic rhinitis	34,988	21,152	-39.54%	-32.2%	-60.8%	-39.5%	-41.9%	-25.7%	-38.8%
C61 Prostate cancer	32,457	27,526	-15.19%	1.1%	-31.0%	-22.7%	-24.0%	-6.1%	-12.8%
D259 Uterine fibroid	31,937	26,413	-17.30%	-15.4%	-46.3%	-16.4%	-8.9%	-3.3%	-11.0%

Source: Data from Global Health Consulting, Japan

Notes: Data from 301 hospitals. Year-on-year comparison of the monthly sum of disease-specific outpatient visits. Sample size was 40,342,799 visits in 2020 and 44,896,434 visits in 2019.

Table 2
Outpatient revisits for most common diagnoses in a sample of Japanese hospitals during 2019 and 2020, and percentage change from 2019, by period.

Diagnosis	Total number of outpatient revisits, Feb–Dec 2019	Total number of outpatient revisits, Feb–Dec 2020	Total percentage change (from 2019)	Initial Phase (Feb–Mar)	First Wave (Apr–May)	Post-First Wave (Jun–Jul)	Second Wave (Aug)	Post-Second Wave (Sep–Oct)	Third Wave (Nov–Dec)
TOTAL (All diagnoses)	38,976,338	35,456,762	−9.03%	−3.7%	−19.7%	−7.9%	−10.7%	−5.1%	−7.8%
I10 Hypertension	2,502,495	2,339,622	−6.51%	−1.3%	−13.5%	−5.0%	−9.0%	−4.1%	−7.2%
E11 Type 2 diabetes mellitus	1,424,033	1,319,898	−7.31%	−2.0%	−14.9%	−6.5%	−9.6%	−4.5%	−7.3%
N189 Chronic kidney disease	1,357,531	1,338,049	−1.44%	1.8%	−4.1%	0.5%	−3.0%	−1.3%	−3.0%
N40 Hypertrophy of prostate gland	783,486	728,767	−6.98%	−1.8%	−13.5%	−5.0%	−9.2%	−4.3%	−9.2%
J459 Bronchial asthma	687,601	540,644	−21.37%	−9.0%	−29.4%	−23.0%	−23.2%	−20.8%	−23.8%
M4806 Lumbar spinal canal stenosis	640,440	577,180	−9.88%	−4.5%	−20.9%	−7.8%	−12.0%	−6.2%	−8.9%
C509 Breast cancer	581,872	541,429	−6.95%	−5.1%	−15.2%	−3.5%	−9.2%	−4.0%	−6.1%
C61 Prostate cancer	577,163	558,727	−3.19%	0.5%	−9.4%	−2.1%	−6.9%	0.2%	−3.4%
M0690 Rheumatoid arthritis	483,446	450,720	−6.77%	−1.0%	−14.6%	−3.8%	−11.0%	−5.0%	−6.9%
M171 Gonarthrosis	452,047	409,564	−9.40%	−6.8%	−22.3%	−5.7%	−10.2%	−5.1%	−6.8%
I209 Angina pectoris	412,516	354,047	−14.17%	−9.2%	−23.7%	−13.5%	−15.9%	−9.4%	−13.8%
K635 Colonic polyp	396,320	353,421	−10.82%	−1.2%	−30.6%	−13.7%	−12.1%	−2.2%	−6.5%
Z961 Intraocular lens insertion eye	366,494	342,045	−6.67%	0.0%	−15.7%	−6.1%	−9.7%	−3.1%	−6.8%
C169 Stomach cancer	331,289	296,804	−10.41%	−5.9%	−22.9%	−8.8%	−12.8%	−4.1%	−9.6%
D259 Uterine fibroid	309,961	284,757	−8.13%	−0.5%	−22.0%	−4.9%	−8.6%	−4.6%	−9.1%
C20 Rectum cancer	307,139	295,753	−3.71%	−1.2%	−12.2%	−0.9%	−4.4%	−1.3%	−2.7%
G409 Epilepsy	289,759	262,822	−9.30%	−5.5%	−18.0%	−8.9%	−10.0%	−5.3%	−8.3%
J304 Allergic rhinitis	284,963	224,644	−21.17%	−14.1%	−33.9%	−22.0%	−19.5%	−15.9%	−20.7%
I639 Cerebral infarction	268,016	230,761	−13.90%	−8.1%	−25.0%	−12.6%	−13.7%	−9.4%	−14.0%
F209 Schizophrenia	258,805	228,701	−11.63%	−4.8%	−20.3%	−10.8%	−15.2%	−8.2%	−11.7%

Source: Data from Global Health Consulting, Japan

Notes: Data from 301 hospitals. Year-on-year comparison of the monthly sum of disease-specific outpatient visits. Sample size was 40,342,799 visits in 2020 and 44,896,434 visits in 2019.

infectious diseases that showed a particularly large decline in admissions. Fig. 1 presents the change in urgent hospital admissions for these four diagnoses for February–May in 2019 and 2020, broken down by age group. There was a clear decrease for each diagnosis in every age group, but the change in admissions among those younger than 15 years old was especially pronounced, with pneumonia decreasing by 47.8% ($p < 0.001$), acute bronchitis by 58.3%, influenza and viral pneumonia by 50.1%, and viral enterocolitis by 69.4%, compared with the same period in 2019. Test results are presented in Table C2.

The number of pneumonia admissions for patients aged 65 and over decreased by 26.4% ($p < 0.001$), which is a somewhat smaller percentage change than the above cases. However, the number of patients in this group is so large that the impact on the total admissions is significant.

In many other countries, people may not be hospitalized so often for influenza, viral enterocolitis, or acute bronchitis. However, they are common diagnoses for urgent hospitalization in Japan, and patients stay in hospital for relatively long periods. Our data from acute care hospitals show that, for viral enterocolitis, the average length of stay is 4.1 days for patients under 15 years old, 5.3 days for those aged 15–64, and 9.1 days for those aged 65 and over. Prolonged hospitalization poses various risks, particularly to the elderly, who are at increased risk of delirium, weakness, and falls. However, quite often, unnecessary admissions are suggested as a way of filling hospital beds [15].

Table 4 shows the total number of diagnosis-specific elective inpatient admissions for 2019 and 2020 for the top 20 most common diagnoses, listed in descending order of the total admissions in 2019, alongside the percentage change for each of the six study periods relative to the same period in 2019. Elective admissions also decreased drastically, particularly for cataracts (−35.2%, $p < 0.001$), polypectomy (“060100 benign disease of the small and large intestine”; −34.4%, $p <$

0.001), cardiac catheterization (“050050 angina pectoris, chronic ischemic heart disease”; −43.8%, $p < 0.001$), and cancer screenings. Test results are presented in Table D1.

Tables A2, B2, C3, and D2 in the Appendix provide a supplementary break-down of the percentage change in diagnosis-specific outpatient visits and inpatient admissions by month, for the 11 months (February–December) of the full study period in 2020, compared with 2019.

5. Discussion

The COVID-19 pandemic has revealed longstanding issues in Japanese health care. The health care system is hospital-centric and the first point of contact is often at hospital. Health care in Japan is funded by universal public insurance, but delivered largely by the private sector. Most clinics are private, and private hospitals also dominate the hospital system, accounting for 80% of hospitals and 70% of total hospital beds. Many private hospitals grew out of small medical practices and have only a small number of beds. This is one of the reasons that, per capita, the number of hospitals and hospital beds in Japan is the largest of the OECD countries.

The health sector is fragmented because of its hospital-centric nature, weak and poor-quality primary care provision, and lack of coordination among medical institutions. All clinics, and 79% of hospitals, are reimbursed solely on a fee-for-service basis, and 21% of hospitals are funded under a combination of the DPC/PDPS (fixed amount per day) and fee-for-service components. This payment system, together with the abundant supply of beds, has provided hospitals with incentives to keep patients much longer than seen in other OECD countries [15]. Outpatient care (provided by both clinics and hospitals) is reimbursed on a fee-for-service basis. The fee-for-service model provides incentives to offer unnecessary investigations, medications, and interventions.

Table 3

Urgent hospital admissions for most common diagnoses in a sample of Japanese hospitals during 2019 and 2020, and percentage change from 2019, by period.

Diagnosis (with (w/) or without (w/o) surgery)	Total number of urgent admissions, Feb–Dec 2019	Total number of urgent admissions, Feb–Dec 2020	Total percentage change (from 2019)	Percentage change by period in 2020 (compared with 2019)					
				Initial Phase (Feb–Mar)	First Wave (Apr–May)	Post-First Wave (Jun–Jul)	Second Wave (Aug)	Post-Second Wave (Sep–Oct)	Third Wave (Nov–Dec)
TOTAL (All diagnoses)	1,658,256	1,486,041	−10.39%	−2.7%	−19.2%	−12.2%	−11.8%	−7.0%	−9.6%
040080 Pneumonia (w/o)	93,214	56,399	−39.50%	−11.0%	−46.9%	−51.9%	−44.2%	−40.9%	−44.5%
010060 Cerebral infarction (w/o)	59,779	57,237	−4.25%	−0.1%	−13.0%	−3.5%	−4.9%	−0.2%	−3.7%
050130 Heart failure (w/o)	58,302	55,154	−5.40%	−2.8%	−14.3%	−7.0%	−9.9%	6.0%	−3.8%
040081 Aspiration pneumonia (w/o)	45,781	40,898	−10.67%	−3.9%	−19.3%	−16.8%	−13.2%	−6.7%	−4.6%
110310 Renal infection (w/o)	41,803	42,022	0.52%	8.4%	−7.4%	3.9%	−4.0%	1.5%	−0.3%
160800 Fracture of proximal femur (w/)	39,676	39,282	−0.99%	2.8%	−9.8%	−1.4%	−2.6%	3.4%	1.0%
040090 Acute bronchitis, Acute bronchiolitis, Lower respiratory tract infection (others) (w/o)	32,130	7,830	−75.63%	−19.4%	−81.5%	−85.8%	−89.4%	−86.7%	−73.2%
060380 Viral enterocolitis (w/o)	27,264	14,819	−45.65%	−27.3%	−73.1%	−47.5%	−31.0%	−25.4%	−44.0%
060340 Bile duct (intra/extra hepatic) lithiasis (w/)	26,794	26,747	−0.18%	3.7%	−5.1%	−0.5%	0.4%	3.4%	−2.5%
140010 Disorder associated with shortened gestation period or low birth weigh (w/o)	26,748	26,127	−2.32%	2.1%	2.7%	−2.1%	−1.5%	−5.7%	−8.5%
060210 Intestinal obstruction without hernia (w/o)	25,736	23,354	−9.26%	−2.6%	−14.5%	−8.5%	−8.0%	−6.8%	−13.6%
040100 Asthma (w/o)	21,694	10,741	−50.49%	−29.9%	−67.8%	−63.4%	−59.9%	−45.0%	−39.6%
050030 Acute myocardial infarction, recurrent myocardial infarction (w/)	19,899	19,523	−1.89%	2.0%	−9.3%	−1.9%	−4.1%	3.5%	−2.5%
010040 Nontraumatic intracranial haematoma (excluding nontraumatic subdural haematoma) (w/o)	18,295	17,627	−3.65%	5.3%	−9.3%	−6.0%	−7.1%	0.3%	−6.8%
010230 Epilepsy (w/o)	18,022	16,584	−7.98%	4.7%	−18.2%	−12.0%	−9.8%	−0.7%	−11.6%
060102 Uncomplicated diverticulosis (w/o)	17,756	16,717	−5.85%	−0.9%	−8.7%	−6.5%	−8.8%	−4.4%	−6.9%
040070 Influenza, viral pneumonia (w/o)	16,577	3,434	−79.28%	−43.9%	−86.0%	−95.8%	−96.1%	−95.5%	−95.4%
040040 Malignant pulmonary tumour (w/o)	16,419	16,031	−2.36%	−0.1%	−4.9%	0.4%	−5.8%	−3.7%	−1.6%
050210 Bradyarrhythmia (w/o)	16,017	16,437	2.62%	−1.2%	−2.1%	0.8%	11.7%	7.9%	4.1%
160690 Impairment from fracture of thoracic or lumbar vertebra or lower (including thoracic/lumbar spinal cord injury) (w/o)	14,760	14,447	−2.12%	−0.7%	−15.9%	2.4%	0.0%	4.2%	−0.7%

Source: Data from Global Health Consulting, Japan

Notes: Data from 455 hospitals. Year-on-year comparison of the monthly sum of disease-specific inpatient admissions

Total 3,578,056 admissions (discharged patients) for 2019, total 3,245,279 admissions (discharged patients) for 2020. We use discharges instead of admissions because, in Japan, the average length of hospital stays is long, with many patients' stays spanning consecutive months. For example, if a patient is hospitalized on October 20th and discharged on November 1st, it is counted in the November figure, not October.

Our analysis shows a drastic decrease in patient demand (both outpatient visits and inpatient admissions) at Japanese acute care hospitals for the entire study period. There is a rebound in outpatient revisits across the periods following the first wave, perhaps as patients feel more comfortable in returning to medical facilities, but the general picture for outpatient revisits is a sharp drop on the previous year.

OECD health data has shown that Japanese people consult a doctor very frequently. Analysis of administrative claims data [16] has shown that the average consultation frequency for hypertension patients is about every 52 days (standard deviation (SD) 22 days) at a hospital, or every 35 days (SD 14 days) at a clinic, and for diabetes patients is about every 48 days (SD 19 days) at a hospital, or every 34 days (SD 13 days) at a clinic. The most common reason for revisits is to obtain a prescription,

which is because repeat prescriptions are not permitted in Japan. Health care providers receive payment for outpatients through the fee-for-service methodology, which rewards frequent consultations with patients.

A sharp decrease in demand was also exhibited among non-COVID-19 infectious diseases. For example, outpatient attendances and inpatient admissions among children under 15 dropped considerably. Hospital admission caused by pneumonia, acute bronchitis, influenza and viral pneumonia, and viral enterocolitis also fell dramatically. People's behavioral changes, such as wearing masks and observing social distancing, probably contributed to this trend, and the trend continued for the whole study period.

Outpatient consultations for the elderly also decreased sharply.

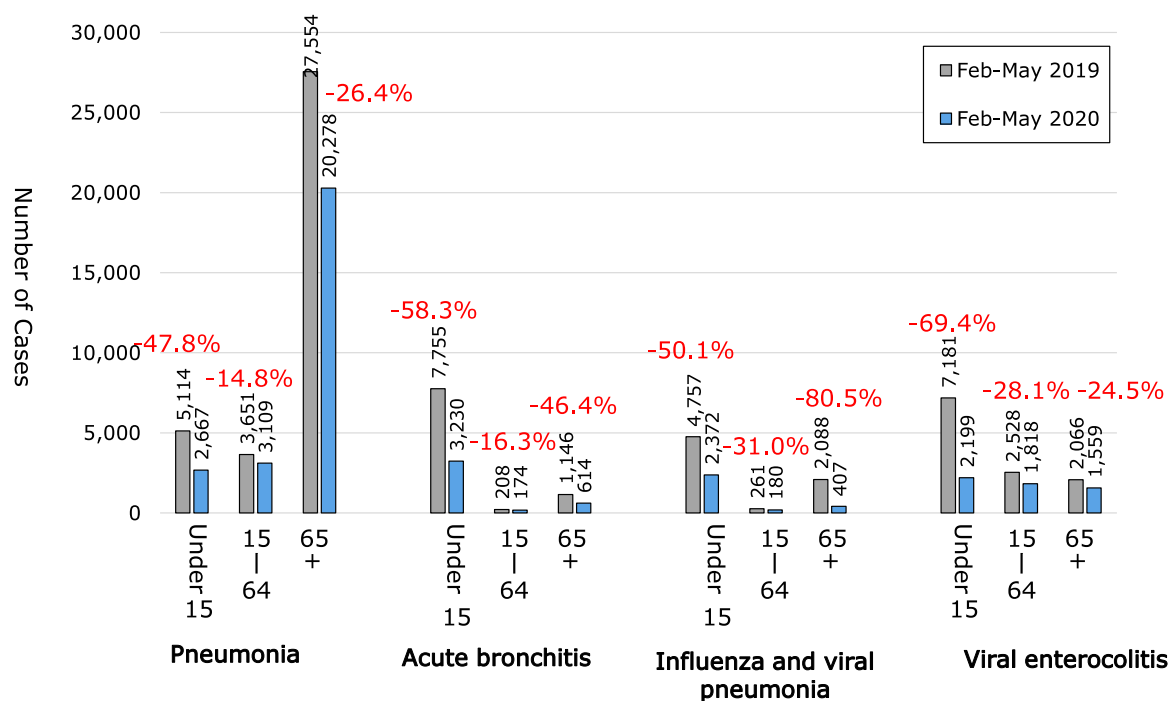


Fig. 1. Comparison of urgent hospital admissions for pneumonia, acute bronchitis, influenza and viral pneumonia, and viral enterocolitis in a sample of Japanese hospitals, for February-May 2019 and 2020, by age group
 Source: Data from Global Health Consulting, Japan, Notes: February–May in 2019 and 2020 for 455 hospitals. Year-on-year comparison of the monthly sum of disease-specific inpatient admissions. Total 1,195,266 discharged patients for 2019, total 1,075,902 discharged patients for 2020. We use discharges instead of admissions because, in Japan, the average length of hospital stays is long, with many patients’ stays spanning consecutive months. For example, if a patient is hospitalized on October 20th and discharged on November 1st, it is counted in the November figure, not October.

Without a gatekeeping system in Japan, many people consult several different specialists for their common diseases. Our data show that acute care hospitals, intended to provide secondary or tertiary care, have provided mild and non-urgent health care. Hypertension, diabetes, lumbar spinal canal stenosis (a cause of lower back pain and numbness in the legs), and gonarthrosis (osteoarthritis of the knee) are common reasons for elderly people to consult doctors at acute care hospitals. Faced with the COVID-19 situation, these outpatient visits have fallen drastically across the board. Many patients may have chosen self-medication or to seek consultation less frequently, or alternatively may have had their use of non-critical outpatient care reduced by the hospitals themselves. This might be evidence of some level of systemic overprovision of health care services.

For inpatient care, the Japan Surgical Society’s recommendation to postpone elective surgical interventions, along with growing public fear of COVID-19, had the effect of reducing elective hospital admissions markedly. In Japan, where the population is aging, cataract surgery is the most frequent surgical procedure for elective hospital admission. Most patients are hospitalized for a few days, while day surgery is the standard practice internationally [17]. Hospitals have an incentive to keep patients longer to fill their beds. Polypectomy and cardiac catheterization are also common reasons for hospitalization at Japanese acute care hospitals.

There are significant decreases in hospitalizations for cancer patients. One of the reasons may be a fall in cancer screenings. As the OECD reported [18], Japan has the most extensive range of health check-ups and screenings of all OECD countries. It is not clear that all tests add value and we should not ignore the risks of duplicative tests, over-diagnosis, and unnecessary exposure to harm [19]. Because there are no restrictions on hospitals or clinics purchasing medical equipment, and hospitals are freely able to provide any specialty service without authorization from government, the number of CT and MRI scanners per capita is significantly higher than the OECD average, and as many as

“two out of every three hospitals, including psychiatric hospitals, have whole-body CT scanners” [12]. It is difficult to judge from our data whether the observed decrease in cancer-related admissions could be partly a decrease in patients who would otherwise have been over-diagnosed, considering that well-equipped hospitals and clinics have incentives to overprovide medical services. We should, however, bear in mind the people who are at high risk for cancers but have missed the opportunity to receive health check-ups or cancer screening owing to the pandemic.

Our data also showed that the sharp decline in outpatient visits and inpatient admissions resulted in a revenue reduction. For example, in May 2020, compared with the same month in 2019, the total claimed hospital charges at hospitals that had COVID-19 patients decreased by 15%, while even hospitals that did not have COVID-19 patients saw their total hospital charges decrease by 8.4%. Similar research results are also presented elsewhere [6]. Meanwhile, since the end of 2020, Japanese hospitals have received generous government subsidies for securing hospital beds for COVID-19 patients, regardless of whether they have subsequently accepted any COVID-19 patients. Interestingly, the receipt of these subsidies has led to most hospitals enjoying higher profits than they did before the pandemic [20], despite the falling patient volumes and lower revenue they have experienced since the pandemic began. While this may temporarily strengthen the financial position of medical institutions, these subsidies will not last forever, and with the trend of declining patient volumes and revenue expected to continue, it is imperative that reform of the payment system is introduced to ensure the long-term viability of Japanese medical providers and, therefore, the sustainability of the health care system as a whole.

Under the COVID-19 pandemic, Japan’s fragmented health care system, with its large number of small- and medium-sized hospitals, proved unfit for purpose. According to Japan’s Ministry of Health, Labour and Welfare [21], as of January 10, 2021, about 20% of the approximately 8,000 hospitals nationwide were able to accept new

Table 4

Elective hospital admissions for most common diagnoses in a sample of Japanese hospitals during 2019 and 2020, and percentage change from 2019, by period.

Diagnosis (with (w/) or without (w/o) surgery)	Total number of elective admissions, Feb–Dec 2019	Total number of elective admissions, Feb–Dec 2020	Total percentage change (from 2019)	Initial Phase (Feb–Mar)	First Wave (Apr–May)	Post-First Wave (Jun–Jul)	Second Wave (Aug)	Post-Second Wave (Sep–Oct)	Third Wave (Nov–Dec)
TOTAL (All diagnoses)	1,900,534	1,742,259	−8.33%	0.9%	−18.6%	−13.9%	−11.9%	−0.4%	−8.0%
020110 Cataract and other disorders of lens (w/)	118,171	97,006	−17.91%	−1.1%	−35.2%	−25.2%	−25.3%	−4.2%	−19.8%
040040 Malignant pulmonary tumour (w/o)	83,439	79,930	−4.21%	2.6%	−7.1%	−7.3%	−12.4%	0.7%	−5.4%
060100 Benign disease of small and large intestine (including benign tumour)	72,642	60,326	−16.95%	−1.1%	−34.4%	−25.5%	−24.6%	−5.7%	−14.7%
050050 Angina pectoris, chronic ischemic heart disease (w/o)	60,470	46,364	−23.33%	−18.7%	−43.8%	−25.7%	−20.8%	−7.5%	−20.5%
050050 Angina pectoris, chronic ischemic heart disease (w/)	40,378	35,599	−11.84%	−4.8%	−26.7%	−18.3%	−12.8%	2.0%	−10.3%
110080 Malignant prostatic tumour (w/o)	38,164	33,946	−11.05%	12.4%	−15.0%	−22.5%	−24.9%	−7.7%	−14.0%
060020 Malignant gastric tumour (w/)	35,963	31,791	−11.60%	3.4%	−8.9%	−22.9%	−20.1%	−14.6%	−10.7%
090010 Malignant breast tumour (w/)	34,768	33,354	−4.07%	7.7%	−3.9%	−9.0%	−6.4%	−5.6%	−7.9%
060160 Inguinal hernia (w/)	33,993	29,711	−12.60%	−2.1%	−36.8%	−14.7%	−8.7%	−0.4%	−12.3%
050070 Tachycardiac arrhythmia (w/)	30,940	29,429	−4.88%	4.9%	−18.3%	−9.9%	−9.7%	6.1%	−4.5%
060035 Malignant tumour of colon (ascending to sigmoid colon) (w/)	30,014	28,947	−3.56%	5.4%	−1.6%	−12.1%	−13.6%	−5.5%	0.4%
110070 Urinary bladder tumour (w/)	28,527	28,139	−1.36%	1.9%	−0.8%	−6.0%	−4.6%	5.2%	−4.8%
130030 Non–Hodgkin lymphoma (w/o)	28,044	29,880	6.55%	10.0%	8.5%	13.4%	5.1%	6.5%	−3.2%
060050 Malignant tumour of liver/ intrahepatic bile duct (including secondary tumour) (w/)	23,468	22,258	−5.16%	−6.4%	−8.0%	−4.7%	−5.2%	0.9%	−7.2%
10007x Type 2 diabetes (excluding diabetic ketoacidosis) (w/o)	22,094	19,363	−12.36%	−2.8%	−30.4%	−22.4%	−12.7%	1.7%	−6.0%
040040 Malignant pulmonary tumour (w/)	21,434	20,847	−2.74%	2.2%	0.5%	−10.0%	−7.2%	−1.1%	−2.6%
060035 Malignant tumour of colon (ascending to sigmoid colon) (w/o)	21,388	20,509	−4.11%	6.2%	−8.8%	−8.0%	−10.9%	0.3%	−6.0%
12002x Malignant tumour of cervix/corpus of uterus (w/)	21,124	20,056	−5.06%	0.8%	−6.5%	−11.9%	−12.5%	−1.1%	−2.9%
120060 Hypertension or other diseases associated with pregnancy/labour/ puerperium (w/)	20,675	18,650	−9.79%	−3.5%	−19.5%	−16.3%	−9.1%	0.1%	−11.1%
070230 Arthropathy of knee (including degenerative disease) (w/)	20,477	19,187	−6.30%	7.9%	−5.7%	−23.2%	−15.2%	−3.8%	−1.6%

Source: Data from Global Health Consulting, Japan

Notes: Data from 455 hospitals. Year-on-year comparison of the monthly sum of disease-specific inpatient admissions

Total 3,578,056 admissions (discharged patients) for 2019, total 3,245,279 admissions (discharged patients) for 2020. We use discharges instead of admissions because, in Japan, the average length of hospital stays is long, with many patients' stays spanning consecutive months. For example, if a patient is hospitalized on October 20th and discharged on November 1st, it is counted in the November figure, not October.

COVID-19 patients. Prefectures offer hospitals financial incentives to secure space for these patients. Some private hospitals have freed up a few beds as requested, but others have been unwilling to provide any, largely because of staff shortages and the management burden it imposes. (Even most university hospitals in Tokyo have been accepting only a few COVID-19 patients.) Prefectures have been scrambling to secure 30,000 beds, which was only 3.4% [22] of the approximate total of 890,000 general beds in Japan as of March 3, 2021.

During the third wave (November and December 2020), large hospitals with more than 400 beds accepted only a median of 6 patients, and small hospitals with less than 200 beds accepted a median of 2.2 patients. This shows serious inefficiency in the health care system. Specialists are dispersed, and there are mismatches in the allocation of medical resources, such as ICU (intensive care unit) and ECMO (extracorporeal membrane oxygenation), meaning that the quality of medical care cannot be guaranteed. This is not only inefficient for treating COVID-19 patients, but for treating any other diseases, too. This is a major reason why, even with its relatively small number of COVID-19 patients compared with other developed countries, Japan has faced a shortage of beds and seen its medical system brought to the brink of collapse.

On the basis of the lessons learned from the COVID-19 pandemic, it is essential to promote specialization in the type of patients treated and a differentiation of medical functions among clinics and small, medium, and large hospitals. It is necessary to reform the payment system because the existing model has a perverse incentive for overprovision in the case of both outpatient visits and inpatient admissions. For outpatients, some capitation element would be appropriate in delivering population-based health promotion and preventive health care activities [15], and for hospitalization, fixed payment based on the disease category, rather than per hospital admission per day (as in DPC), would drive hospitals to improve efficiency and quality.

6. Conclusions

Analyzing data from a large, nationally distributed group of Japanese hospitals, we found a dramatic decline in both inpatient and outpatient volumes over the three waves of the COVID-19 pandemic in Japan from February to December 2020, compared with the same period in 2019. We identified three key reasons for this fall in patient demand. First, COVID-19-related hygiene measures and behavioral changes significantly reduced non-COVID-19 infectious diseases. Second, consultations relating to chronic diseases fell sharply. Third, certain medical investigations and interventions were postponed or cancelled.

In the wake of the COVID-19 pandemic, the longstanding and systemic problems in Japan's health care system have been starkly revealed. Our analysis has shown that, even faced with dramatic falls in patient volumes across the board – for inpatients and outpatients, for urgent and non-urgent care, and for nearly all diagnosis categories – the inefficiencies and fragmented nature of the hospital system meant that a crisis was inevitable, with the management of many medical institutions reaching breaking point.

In Japan, the world's most super-aging society, poor coordination among health care providers is a serious weakness in the system. Although the government offers universal public health insurance, its governance of the health care system is highly decentralized. Responsibilities for planning the health system and delivering health services are split among different levels of government and among various providers.

Hospitals and doctors freely choose their mode of practice and their specialties because there is no exclusive specialty board certification. This *laissez-faire* system has created a mismatch between patient needs and the supply of health care resources, and impeded accountability for quality of care [15]. The government can exert control over neither private hospitals (80% of all hospitals) nor public hospitals.

Under the current health system, rather than hospitals and clinics

having an incentive to prevent disease in patients, they are rewarded for keeping patients for longer than necessary because of the abundant supply of beds and the per diem/fee-for-service payment systems. This creates a situation whereby hospitals actually compete for outpatients because of the fee-for-service payment system, and hospitals are routinely overproviding services that, we suggest, could have been managed at home in many circumstances if a standardized primary care team had been available in the community.

Since the end of 2020, Japanese hospitals have been paid generous subsidies for securing hospital beds for COVID-19 patients. Most hospitals have therefore enjoyed higher profits than they did pre-pandemic, despite the large fall in non-COVID-19 patient numbers and associated revenue. However, these financial subsidies will not last forever, and it is therefore vital not only for the long-term viability of the health care system but also for hospitals themselves that the issues identified in this paper are addressed and the proposed reforms are implemented. We need to promote specialization and differentiation of medical functions, along with appropriate payment reform, in order for our health system to be sustainable.

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Declaration of Competing Interest

None.

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Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.healthpol.2022.09.005.

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