

## **Title**

### **Trends in patients' willingness for cancer care and the number of registered cancer cases in Ehime Prefecture during the COVID-19 pandemic**

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## Abstract

### OBJECTIVE

This study aimed to elucidate the recovery of cancer care from the COVID-19 pandemic in Ehime Prefecture, Japan.

### DATA SOURCE AND DESIGN

This study collected data from the hospital-based cancer registry (HBCR) as well as the number of outpatients, medical information provision fee payments (MIP2), and second opinion patients (SOP) from the Council of Ehime Cancer Care Hospitals (ECCH). Then cancer care and patient requests for hospital transfers before and during the COVID-19 pandemic were analyzed.

### RESULTS

The HBCR from the ECCH comprises >80% of cancer cases in Ehime Prefecture. In 2020, the numbers of all registered cases, first-line treatment cases, and cases detected by cancer screening in the HBCR decreased from those in 2018–2019. In 2021, they increased to almost the same levels as those in 2020. In contrast, the number of registered patients that changed hospitals (hospital-change cases) after first-line treatments, patients who lived outside the metropolitan area of Ehime but registered in metropolitan hospitals, MIP2, and SOP remained low in 2021 after decreasing in 2020. Furthermore, using the Wilcoxon rank sum test, the monthly numbers of hospital-change cases, MIP2, and SOP were significantly smaller in 2021 than in 2018–2019.

### CONCLUSION

The assessed indicators suggest that the willingness of cancer patients to improve and/or advance cancer care had not returned to pre-pandemic levels by 2021. Hence, psychological measures in society and support for patient caregivers are necessary to prevent self-restraint in patients receiving cancer care.

## Introduction

Ehime Prefecture is one of the 47 local government areas in Japan, with a population of 1.34 million in 2019 and a nominal gross domestic product (GDP) of 5 trillion yen, about one-hundredth of Japan's population and GDP, respectively <sup>1</sup>. Ehime Prefecture has problems common to the rest of Japan, such as a declining birth rate, an aging population, and a population concentration in the prefecture's center <sup>1</sup>. Approximately half of the residents live in the Matsuyama metropolitan area (Metro), which has a comprehensive cancer center, a university hospital, and the largest and second-largest general hospitals in the prefecture <sup>2</sup>.

The Council of Ehime cancer care hospitals (ECCH) comprises 7 hospitals designated by the Ministry of Health, Labour and Welfare of Japan (MHLW) and 8 designated by the Ehime prefecture <sup>3,4</sup>. Although apart from Shikoku Cancer Center, these hospitals do not specialize in cancer care, they are recognized by the MHLW and/or Ehime Prefecture to meet the standards for staff and facility quality and the number of cancer treatments. Therefore, the ECCH-designated hospitals are expected to be the main institutes for cancer treatment in their medical districts. ECCH hospitals must have a hospital-based cancer registry (HBCR) <sup>5</sup>.

The ECCH annually publishes "*Cancer Care in Ehime Prefecture Visualized by Cancer Registry*" in print and on a website <sup>2</sup> to evaluate the status of cancer care in Ehime Prefecture using the Ehime prefectural hospital-based cancer registries (EHBCR), and HBCR of ECCH hospitals accumulated since 2012. It is usually the earliest publication on the prefectural cancer registry results of the preceding year in Japan. This publication shows the centralization of cancer care to the hospitals in Metro for some cancers, such as lung, breast, and gynecologic cancers <sup>2</sup>.

Most patients' cancer treatment in Ehime prefecture is completed at the ECCH hospitals, with few patient requests for transfers to hospitals in other prefectures <sup>4</sup>. According to the population-based cancer registry of Ehime, a part of Japan's National Cancer Registry, 81.2% of all cancers diagnosed in Ehime prefecture in 2017–2018 were diagnosed and/or treated in some ECCH hospitals <sup>6</sup>. Furthermore, active first-line cancer treatment with surgery and/or chemotherapy is infrequent in non-ECCH hospitals.

The COVID-19 pandemic is known to have reduced the number of cancer cases diagnosed and treated worldwide <sup>7</sup>. The COVID-19 pandemic also impacted cancer care in Japan in 2020 because important medical procedures such as cancer screening and endoscopic examinations were restricted <sup>8,9</sup>. However, the restriction of medical treatment is not solely due to a lack of medical resources; there is also the pandemic's influence on the social psychology of cancer patients <sup>10-12</sup>. Hence, the restriction of medical treatment due to medical resource problems and the pandemic's influence on cancer patients' social psychology needs to be elucidated, although in many respects, cancer care in Japan rebounded in 2021.

We hypothesized that the EHBCR and some additional data could elucidate cancer treatment in Japan as a one-hundredth microcosm.

## **Material and Method**

### *Ehime prefectural hospital-based cancer registries*

This study included the numbers of (i) all registered cases, (ii) patients receiving first-line treatment (first-line treatment cases), (iii) patients on watchful waiting as the first line of treatment (watchful-waiting cases), (iv) the cases detected by cancer screening (screening cases), and (v) patients who requested hospital transfers for further treatment after first-line treatments (hospital-change cases) in 2018–2021 from the EHBCR. The exclusion criteria included registered cases in the published EHBCR that were neither diagnosed, treated for cancer, nor followed up by watchful waiting in the hospitals. In addition, the cases were divided based on address into either Metro hospital cases of patients whose addresses were in Metro (M-M) or Metro hospital cases of patients who visited from the peripheral areas of Ehime or other prefectures (M-P).

### *Other additional information from ECCH hospitals collected for the analysis*

The monthly numbers of (i) outpatients from all the ECCH hospitals in 2018–2021 were collected, (ii) patients who were charged medical information provision fee II (MIP2), and (iii) patients who received a second opinion at the hospitals (second-opinion patients) <sup>11,13</sup>. MIP2 is a fee that hospitals charge patients needing a medical

referral letter when requesting a second opinion in another hospital (MHLW, Table of Medical fees) <sup>14</sup>. The number of MIP2 and second-opinion patients reflects the number of patients willing to visit medical doctors in other hospitals, hoping to receive better counseling for cancer care.

### *Statistical analysis*

The monthly numbers of the collected items were analyzed using the Wilcoxon rank sum test to compare the changes in cancer care in Ehime Prefecture before and during the pandemic. Differences were considered statistically significant at p-values <0.05. All statistical analyses were performed using Stata Version 17.0 (Stata Corp, College Station, TX, USA).

## **Results**

### *Changes in the number of hospital-based cancer registrations in Ehime Prefecture before and during the COVID-19 pandemic*

The numbers of all registered, first-line treatment, and screening cases in the EHBCR decreased in 2020 and increased in 2021 to almost the pre-COVID-19 levels (Table 1). The number of watchful-waiting cases increased in 2020 but decreased in 2021. Furthermore, the number of hospital-change cases decreased in 2020 and did not increase to pre-COVID-19 levels.

All registered and first-line treatment M-M cases decreased to 95.1% and 97.3% in 2020 from 2018–2019 (mean); they recovered to 100.4% and 101.0%, respectively, in 2021. In contrast, those of M-P cases decreased to 96.6% and 97.9%, respectively, in 2020. Unlike the M-M cases, no recovery was observed in 2021 (96.8% and 97.8 %, respectively) (Table 1).

The monthly numbers of all registered, first-line treatment, and screening cases decreased largely in May 2020 (Figure 1), when the Japanese government declared the first state of emergency. However, all registered and first-line treatment cases immediately increased to the normal annual levels, and the number of screened cases recovered relatively slowly until the end of 2020 (Figure 1). In December 2020 and January 2021, when the number of people infected with COVID-19 increased in

Japan, the number of registered, first-treatment, and screening cases decreased again. However, they rapidly returned to the normal pre-COVID-19 monthly numbers. Meanwhile, the monthly number of hospital-change cases decreased in 2020 and did not return to the pre-COVID-19 level.

In the Wilcoxon rank sum test, the monthly number of screening cases was significantly smaller in 2020 (median: 114.5,  $p=0.044$ ) than in 2018–2019 (137.5); however, it increased in 2021 (133,  $p=0.875$ ) (Table 2). The changes in the monthly numbers of all registered and first-line treatment cases before and during the pandemic were insignificant (Table 2). In comparison, the numbers of hospital-change cases were relatively smaller in 2020 (median: 94 /month,  $p=0.071$ ) and significantly smaller in 2021 (91.5,  $p=0.018$ ) than in 2018–2019 (103) (Table 2).

#### *Changes in the numbers of outpatients charged MIP2 and second-opinion patients in ECCH before and during the COVID-19 pandemic*

The numbers of charged MIP2 and second-opinion patients decreased in 2020 and further in 2021 (78.1% to 73.1% and 83.8% to 71.4%, respectively) compared to the mean in 2018–2019 (Table 1). Outpatients increased slightly in 2021 (2,684,062) after a decrease in 2020 (2,646,449); however, the number remained small at 94.6% of the number of outpatients in 2018–2019.

The monthly number of outpatients, MIP2 payments, and second-opinion patients decreased from April 2020, just before the first state of emergency was declared, and generally remained lower than the pre-COVID-19 levels, with some monthly increases and decreases (Figure 2). The Wilcoxon rank sum test showed that compared to the monthly numbers of outpatients, the monthly numbers of MIP2 payments were significantly lower in 2020 than those in 2018–2019 ( $p=0.001$  and  $0.004$ ) and 2021 ( $p=0.006$  and  $0.001$ ), respectively. The monthly numbers of second-opinion patients in 2021 were also significantly fewer than those in 2018–2019 ( $p=0.001$ ) (Table 2).

## **Discussion**

In Ehime Prefecture, as well as in Japan, both the numbers of people infected with COVID-19 and related deaths increased in 2021 <sup>15</sup>.

The numbers of registered, screening, first-line treatment, and active treatment (first-line treatment cases minus watchful-waiting cases) cases are indicators of cancer care activities in an area <sup>5</sup>. The EHBCR of 2021 showed that these indicators increased from their 2020 levels to almost their pre-COVID-19 levels (Table 2). This suggests that primary cancer treatment in Ehime Prefecture recovered after the COVID-19 pandemic, presumably due to the establishment of cancer treatment systems, such as hospital-hospital collaboration and infection control measures at cancer screening institutions, during the pandemic.

On the other hand, the numbers of hospital-change cases, MIP2 payments, and second-opinion patients did not change in 2021, even after the recovery of the other indicators reflecting the number of active cancer treatments. Furthermore, although the numbers of all registered and first-line treatment of M-M cases recovered in 2021, those of M-P cases did not. This suggests that a proportion of cancer patients who live in the peripheral areas hesitated to undergo a trip to visit Metro hospitals, especially older and/or symptomatic patients <sup>2</sup>.

These indices were supposed to reflect the decline in patients' willingness to receive cancer treatment <sup>7, 11, 16</sup>. Although the pandemic was not severe enough to restrict patients' hospital visits for primary cancer care in 2021, various psychological restraints, and restrictions on transportation for patients' caregivers and visits by family and friends after hospitalization, might have caused a decline in patients' desire to receive medical care. Hence, psychological measures and support for patient caregivers are necessary to prevent self-restraints due to the effects of the COVID-pandemic on the sentiments of patients with cancer toward receiving cancer care.

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## **ETHICAL APPROVAL**

This research was approved by the institutional review board of Shikoku Cancer Center (Code: CO 2022-02), and was conducted in accordance with the Declaration of Helsinki.

## **INFORMED CONSENT**

Informed consent was not necessary in terms of the research ethics guidelines of Japan.

## **DATA AVAILABILITY STATEMENT**

This work was based on “COVID Bulletin: Cancer Care in Ehime Prefecture Visualized by Cancer Registry,” one of the official publications of Ehime Cancer Care Hospitals (ECCH) supported by the Ehime Prefectural Government. The data included in this study are publicly available on the ECCH home page. All the data in the Ehime prefectural hospital-based cancer registries are available through *Ehime Cancer Information Database Project* if the application is considered to be relevant and is



approved by the Shikoku Cancer Center IRB.

## KEYWORDS

COVID-19, Hospital-based cancer registry, Patient's willingness, Second opinion

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TABLE 1

Annual summary of cancer care indicators in Ehime Prefecture before (2018–2019) and during the COVID-19 pandemic (2020 and 2021)

	Year				
	2018– 2019	2020	2021	2018– 2019	2020
	N (mean)	N	/2018– 2019 (%)	N	/2018– 2019 (%)
EHBCR <sup>1</sup>					
All registered <sup>2</sup>	13,714.5	13,304	97.0%	13,687	99.8
M-M <sup>3</sup>	6173	5,873	95.1%	6,196	100.4%
M-P <sup>4</sup>	3313.5	3,202	96.6%	3,208	96.8%
First-line treatment <sup>5</sup>	11,130.0	10,922	98.1%	11,094	99.7
M-M	5247.5	5,107	97.3%	5,299	101.0%
M-P	2850	2,790	97.9%	2,788	97.8%
Watchful-waiting <sup>6</sup>	1,138.5	1,152	101.2%	1,038	91.2
Hospital-change <sup>7</sup>	1,232.5	1,138	92.3%	1,089	88.4
Screening <sup>8</sup>	1,617.5	1,317	81.4%	1,627	100.6
Additional data					
Outpatients <sup>9</sup>	2,836,187	2,646,449	93.3%	2,684,062	94.6%
Second opinions <sup>10</sup>	489	410	83.8%	349	71.4%
MIP2 <sup>11</sup>	481.5	376	78.1%	352	73.1%

1) EHBCR: Ehime Prefectural Hospital-based Cancer Registry. 2) All registered cases were diagnosed, treated for cancer, or followed up by watchful waiting in the hospitals. 3) Patients from the Metropolitan Area who registered at the Metropolitan Hospital. 4) Cases registered at the Metropolitan Hospital of patients who lived in peripheral areas of Ehime. 5) Patients who received the first-line treatment. 6) Cases of watchful waiting as a first-line treatment. 7) Patients who received further treatment in the hospitals after first-line treatment in other hospitals. 8) Cases detected by cancer screening. 9) Outpatient hospitals belong to the Council of Ehime Cancer care hospitals (ECCH Hospitals). 10) Patients who received a second opinion at ECCH hospitals. 11) Patients

who were charged medical information provision fee II, which is a medical fee that hospitals charge patients who need a referral letter to request a second opinion from another hospital.

TABLE 2

Monthly summary of cancer care indicators in Ehime Prefecture before (2018–2019) and during the COVID-19 pandemic (2020 and 2021)

	Year	Median	[min–max]	p-values <sup>8</sup>
All registered <sup>1</sup>	2018–2019	1140.5	[989–1304]	
	2020	1119.5	[871–1262]	0.402
	2021	1179.5	[918–1245]	0.753
First-line treatment <sup>2</sup>	2018–2019	918	[776–1054]	
	2020	924.5	[697–1035]	0.827
	2021	954.5	[736–1032]	0.712
Hospital-change <sup>3</sup>	2018–2019	103	[72–126]	
	2020	94	[80–111]	0.071
	2021	91.5	[68–106]	0.018
Screening <sup>4</sup>	2018–2019	137.5	[89–177]	
	2020	114.5	[53–152]	0.044
	2021	133	[81–191]	0.875
Outpatients <sup>5</sup>	2018–2019	238,416	[216,691–254,604]	
	2020	222,088.5	[182,712–238,921]	0.001
	2021	228,579	[199,238–243,064]	0.006
Second opinions <sup>6</sup>	2018–2019	40	[22–68]	
	2020	33	[24–47]	0.051
	2021	28	[21–43]	0.001
MIP2 <sup>7</sup>	2018–2019	41	[23–58]	
	2020	27.5	[23–45]	0.004
	2021	28.5	[20–45]	0.001

1-7) See the legend of Table 1. 8) The monthly numbers of each item before and during the pandemic were compared to see the years using the Wilcoxon rank sum test. Statistical significance was set at  $p < 0.05$ .

## Figure legends

FIGURE 1. The number of registered cases in Ehime by month before and during the COVID-19 pandemic

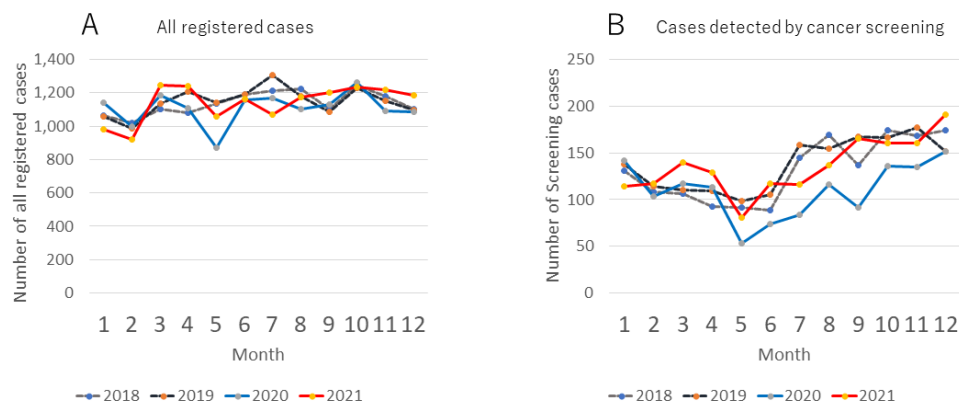


FIGURE 1. Monthly numbers of registered cases in Ehime before and during the COVID-19 pandemic

The lines and dashed lines indicate the monthly numbers of registered cases each year. a) Line graph of all registered cases: there was a large drop in May 2020 (blue line), and the number returned to normal around September 2020. The red line (2021) runs with the dashed lines (2018–2019). b) Line graph of the number of cases detected by cancer screening: As with all registered cases, there was a large reduction in May 2020. However, it took longer to return to the pre-COVID-19 levels by the end of the year than the number of all registered cases (blue line).

FIGURE 2. The number of medical information provision (MIP) fee and second opinion patients of Ehime cancer care hospitals by month before and during the COVID-19 pandemic

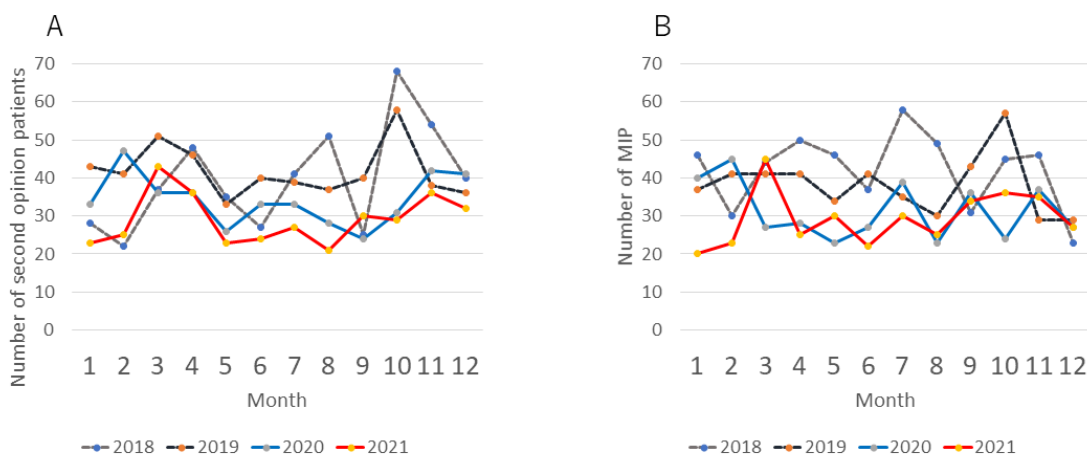


FIGURE 2. Monthly numbers of medical information provision II fee payments and second-opinion patients in Ehime cancer care hospitals before and during the COVID-19 pandemic

Lines and dashed lines indicate the monthly numbers of second-opinion patients and medical information provision fee II (MIP2) payments each year. There was a large reduction in the number of second-opinion patients in May 2020 (a, blue line), and MIP2 payments decreased in April 2020 (b, blue line). Both run below the dashed lines (2018–2019) in most months through 2020 and 2021 (a, b).