Incidence and Mortality of Emergency Patients Transported by Emergency Medical Service Personnel during the Novel Corona Virus Pandemic in Osaka Prefecture, Japan: A Population-Based Study

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Abstract: Although the COVID-19 pandemic affects the emergency medical service (EMS) system, little is known about the impact of the COVID-19 pandemic on the prognosis of emergency patients. This study aimed to reveal the impact of the COVID-19 pandemic on the EMS system and patient outcomes. We included patients transported by ambulance who were registered in a population-based registry of patients transported by ambulance. The endpoints of this study were the incident number of patients transported by ambulance each month and the number of deaths among these patients admitted to hospital each month. The incidence rate ratio (IRR) and 95% confidence interval (CI) using a Poisson regression model with the year 2019 as the reference were calculated. A total of 500,194 patients were transported in 2019, whereas 443,321 patients were transported in 2020, indicating a significant decrease in the number of emergency patients transported by ambulance (IRR: 0.89, 95% CI: 0.88–0.89). The number of deaths of emergency patients admitted to hospital was 11,931 in 2019 and remained unchanged at 11,963 in 2020 (IRR: 1.00, 95% CI: 0.98–1.03). The incidence of emergency patients transported by ambulance decreased during the COVID-19 pandemic in 2020, but the mortality of emergency patients admitted to hospital did not change in this study.

Keywords: COVID-19; emergency medical service; ambulances; incidence; mortality; epidemiology
1. Introduction

Outbreaks of infection by the novel corona virus (COVID-19), which was confirmed in Wuhan, China in December 2019, have spread not only in China but also around the world. In Japan, the number of patients with COVID-19 was about 740,000 on 31 May 2021 [1]. The characteristics of COVID-19 are that some of its symptoms, such as fever, cough, sore throat, and general malaise, are common with other upper respiratory tract infections, and some patients are asymptomatic [2]. However, 20% of COVID-19 patients are severely affected and admitted to hospital, and a lower but not negligible rate (3–4%) also need intensive management in the ICU, for their acute respiratory failure, by intubation and mechanical ventilation [3].

As the number of patients with COVID-19 increased, especially in Europe and the United States, the number of health care workers infected with COVID-19 also increased, placing aspects of the health care system, such as emergency medicine and intensive care, into a worldwide state of crisis [4]. The health care system in Japan is funded by public health insurance, and the emergency medical service (EMS) system, which handles all ambulance calls, is a free public service [5]. However, the impact of the COVID-19 pandemic on the EMS system has not been fully revealed, and little is known about the impact of the COVID-19 pandemic on the prognosis of emergency patients.

Osaka Prefecture is the largest metropolitan area in western Japan, with a population of 8.8 million. The annual number of ambulance calls is about 500,000 in this area and that of patients transported to hospital by ambulance is about 200,000 [6]. After the first patient in Osaka Prefecture was confirmed to have COVID-19 on 23 January 2020, the cumulative number of patients with COVID-19 in the prefecture rose to 1732 by 31 May 2020, which was considered the first surge of COVID-19 [7]. We previously revealed the characteristics and outcome of patients with COVID-19 in Osaka Prefecture [7]. Those patients in Osaka Prefecture suspected of having COVID-19 based on their medical and travel history were transferred to a hospital that specializes in the management of COVID-19 for PCR testing. When a COVID-19 outbreak was reported in places such as bars and live music venues, the staff in each public health centre in charge followed up on the people involved, and data on the individuals with positive PCR test results were collected to determine whether they were asymptomatic. All patients with positive PCR test results for COVID-19 were reported to the public health centres in accordance with the Infectious Disease Control Law [8]. In Osaka Prefecture, the first patient with COVID-19 was identified on 23 January 2020, and by 31 December 2020, 466,416 PCR tests had been conducted and the number of patients with COVID-19 was 29,999 [9]. In Japan, due to an increase in the number of patients with COVID-19, the Japanese government declared a state of emergency based on the law on 7 April 2020. At that time, we revealed the influence of the COVID-19 pandemic on the EMS system in Osaka City [10]. The goals of this investigation were to determine the impact of the COVID-19 pandemic on the incident number of emergency patients transported by ambulance (emergency patients) and the number of deaths of emergency patients admitted to hospital.

2. Materials and Methods

2.1. Study Design and Settings

This was a retrospective descriptive study with a study period from 1 January 2019 to 31 December 2020. All data about patients who were transported by ambulance from ambulance call to hospital discharge were entered into the ORION (Osaka Emergency Information Research Intelligent Operation Network) system. Information on the system configuration of ORION was previously described in detail [6,11]. ORION data are considered administrative records, and the ORION data are anonymized without specific personal data, such as patient name, date of birth, and address. Therefore, the requirement of obtaining patient informed consent was waived. This study was approved by the Ethics Committee of Osaka University Graduate School of Medicine (approval no. 15003).
2.2. Setting and Selection of Patients

In 2019, 8,823,452 people lived in the 1905 km² area of Osaka Prefecture [12]. Of that population, 4,235,996 people (48.0%) were male and 2,382,016 people (27.0%) were elderly, aged 65 years old or more. We included patients transported by ambulance whose cleaned data were recorded in the ORION system. Therefore, we excluded patients who were not registered in the ORION system or who had missing data.

2.3. Outcomes

The primary endpoints of this study were the incident number of patients transported by ambulance in each month of the study period and the number of deaths of emergency patients admitted to hospital in each month. In this study, patients who died in the emergency department were excluded from the outcome.

2.4. Measurements

The ORION system checks for errors in the input in-hospital data, and the staff of each emergency hospital can correct them, if necessary. Through these tasks, cell phone app data, ambulance records, and the in-hospital data such as diagnosis and prognosis can be comprehensively registered for each patient transported by an ambulance. The registered data are cleaned by the Working Group to analyse the emergency medical care system in Osaka Prefecture. Among the collected and cleaned data, we excluded inconsistent data that did not contain all of the cell phone app data, ambulance records, and in-hospital data such as diagnosis and prognosis. In addition, we also excluded patients whose sex as registered by the fire department did not match that registered by the hospital or whose sex identifier was missing. We also excluded patients whose age input by the fire department and that by the hospital differed by 3 years or more. When this difference was present, we defined the age input by the hospital as the patient’s true age [5].

2.5. Data Analysis

First, we calculated the number of patients transported by ambulance by reason for ambulance call on a monthly basis from January to December 2020. As a control, we calculated the same data on a monthly basis from January to December 2020. Reason for ambulance call was divided into ‘fire accident’, ‘natural disaster’, ‘water accident’, ‘traffic accident involving car, ship, or aircraft’, ‘injury, poisoning, and disease due to industrial accident’, ‘disease and injury due to sports’, ‘other injury’, ‘trauma due to assault’, ‘acute disease’, ‘interhospital transport’, and ‘others’ [6,11]. To evaluate the impact of the COVID-19 pandemic on the EMS system, we calculated the incidence rate of the number of emergency patients. We also calculated the incidence rate ratio (IRR) and its 95% confidence interval (CI) using a Poisson regression model with the year 2019 as control year. We categorized the patients by age group (children (0–19 years old), adult (20–64 years old), and elderly (65 years old and over)) and also calculated their respective IRR and 95% CI values. Next, we calculated the number of deaths of emergency patients admitted to hospital by reason for ambulance call in each month and similarly calculated the IRR and its 95% CI values. The offset for calculating the IRR was set to the population of Osaka Prefecture in 2019 (8,823,452 people) [12]. The death of emergency patients admitted to hospital was defined from the outcome at 21 days after hospital admission. In addition, in a subgroup analysis, we selected the patients transported by ambulance whose reason for ambulance call was ‘acute disease’ and similarly calculated the IRR and 95% CI values. Statistical analyses were performed using STATA version 16.0 MP software (StataCorp LP, College Station, TX, USA). This manuscript was written based on the STROBE statement to assess the reporting of cohort and cross-sectional studies [13]. All methods in this study have been carried out in accordance with the declaration of Helsinki.
3. Results

The total number of patients registered in ORION was 512,054 in 2019, of which 500,194 (97.7%) were eligible for analysis after excluding cases with missing data. In addition, the total number of patients registered in ORION was 451,524 in 2020, of which 443,321 (98.2%) were eligible for analysis after excluding cases with missing data. Among the 443,321 patients registered in the ORION registry from January to December 2020, 193,060 patients were hospitalized, and 11,963 patients were dead at 21 days after hospital admission. In contrast, among the 500,194 patients registered in the ORION system from January to December 2019, 203,889 patients were hospitalized, and 11,931 patients were dead at 21 days after hospital admission.

3.1. Incidence Analyses by Reason of Ambulance Call

Table 1 shows the number of emergency patients and the IRR (95% CI) in each month by the reason for ambulance call during the study period. The number of emergency patients from January to December 2020 \( (n = 443,321) \) was significantly decreased from that transported from January to December 2019 \( (n = 500,194) \) (IRR: 0.89, 95% CI: 0.88–0.89). The most common reason for an ambulance call was ‘acute disease’ for 340,655 patients in 2019 and 300,502 patients in 2020. During the study period, the reasons for an ambulance call for which the number of emergency patients decreased were ‘traffic accident involving car, ship, or aircraft’ (IRR: 0.86, 95% CI: 0.85–0.87), ‘injury, poisoning, and disease due to industrial accident’ (IRR: 0.82, 95% CI: 0.79–0.86), ‘disease and injury due to sport’ (IRR: 0.57, 95% CI: 0.53–0.60), ‘other injury’ (IRR: 0.92, 95% CI: 0.91–0.93), ‘trauma due to assault’ (IRR: 0.88, 95% CI: 0.84–0.93), ‘acute disease’ (IRR: 0.88, 95% CI: 0.88–0.89), and ‘interhospital transport’ (IRR: 0.90, 95% CI: 0.89–0.91). By month, the greatest decrease in the number of emergency patients was in April (IRR: 0.78, 95% CI: 0.76–0.79), followed by May (IRR: 0.79, 95% CI: 0.78–0.80).

Table 2 shows the number of emergency patients and the IRR (95% CI) in each month by the age groups during the study period. In the subgroup analysis by age group, the number of emergency patients decreased among children during the study period (IRR: 0.68, 95% CI: 0.67–0.69). However, for adults and the elderly, the number of emergency patients decreased after March 2020 compared to that in 2019.

3.2. Mortality Analyses by Reason of Ambulance Call

Table 3 shows the number of deaths of emergency patients admitted to hospital and the IRR (95% CI) in each month by the reason for ambulance call. The number of deaths of emergency patients admitted to hospital was 11,931 in 2019 and remained essentially unchanged at 11,963 in 2020 (IRR: 1.00, 95% CI: 0.98–1.03). There was no statistically significant change in the number of deaths of emergency patients admitted to hospital for each reason for an ambulance call between 2019 and 2020, and no statistically significant differences were identified between 2019 and 2020 for each month.

Table 4 shows the number of deaths of emergency patients admitted to hospital and the IRR (95% CI) in each month by age groups. In subgroup analysis by age group, there was no increase of the number of deaths of emergency patients admitted to hospital among children (IRR: 0.81, 95% CI: 0.54–1.21), adults (IRR: 0.98, 95% CI: 0.91–1.05), and the elderly (IRR: 1.01, 95% CI: 0.98–1.04).
| Event Type                  | Average (95% CI) | p-value | IRR (95% CI) | p-value |
|-----------------------------|------------------|---------|--------------|---------|
| Acute disease               |                  |         |              |         |
| 2019                        | 34.239 (25.757, 42.712) | 0.00 | 0.90 (0.87-0.92) | 0.00 |
| 2020                        | 30.857 (24.018, 38.696) | 0.00 | 1.00 (0.87-0.98) | 0.00 |
| Disease and injury due to sport | 141 (144, 138) | 0.04 | 0.87 (0.82-0.91) | 0.00 |
| Disaster                    |                  |         |              |         |
| 2019                        | 135 (166, 105) | 0.01 | 0.98 (0.89-1.07) | 0.00 |
| 2020                        | 141 (144, 138) | 0.04 | 0.87 (0.82-0.91) | 0.00 |
| Industrial accident         |                  |         |              |         |
| 2019                        | 2897 (2445, 2546) | 0.01 | 0.98 (0.93-1.03) | 0.50 |
| 2020                        | 2895 (2435, 2567) | 0.01 | 0.98 (0.93-1.03) | 0.50 |
| Interhospital transport     |                  |         |              |         |
| 2019                        | 1.00 (1.00) | 0.98 | 0.98 (0.93-1.03) | 0.00 |
| 2020                        | 1.00 (1.00) | 0.98 | 0.98 (0.93-1.03) | 0.00 |
| Natural disaster            |                  |         |              |         |
| 2019                        | 116 (573, 617) | 0.07 | 0.97 (0.94-1.01) | 0.11 |
| 2020                        | 116 (573, 617) | 0.07 | 0.97 (0.94-1.01) | 0.11 |
| Other injury                |                  |         |              |         |
| 2019                        | 265 (217, 250) | 0.03 | 0.68 (0.60-0.75) | 0.30 |
| 2020                        | 265 (217, 250) | 0.03 | 0.68 (0.60-0.75) | 0.30 |
| Self-induced injury         |                  |         |              |         |
| 2019                        | 197 (195, 245) | 0.03 | 0.68 (0.60-0.75) | 0.30 |
| 2020                        | 197 (195, 245) | 0.03 | 0.68 (0.60-0.75) | 0.30 |
| Traffic accident            |                  |         |              |         |
| 2019                        | 2620 (2578, 3027) | 0.02 | 0.68 (0.60-0.75) | 0.30 |
| 2020                        | 2635 (2578, 3027) | 0.02 | 0.68 (0.60-0.75) | 0.30 |
| Involving car, ship, or aircraft | 195 (106, 97) | 0.03 | 0.68 (0.60-0.75) | 0.30 |
| 2019                        | 268 (207, 232) | 0.03 | 0.68 (0.60-0.75) | 0.30 |
| 2020                        | 268 (207, 232) | 0.03 | 0.68 (0.60-0.75) | 0.30 |
| Trauma due to assault       |                  |         |              |         |
| 2019                        | 250 (245, 255) | 0.03 | 0.68 (0.60-0.75) | 0.30 |
| 2020                        | 250 (245, 255) | 0.03 | 0.68 (0.60-0.75) | 0.30 |
| Water accident              |                  |         |              |         |
| 2019                        | 9 (6, 13) | 0.05 | 0.68 (0.60-0.75) | 0.30 |
| 2020                        | 9 (6, 13) | 0.05 | 0.68 (0.60-0.75) | 0.30 |
| Other                       |                  |         |              |         |
| 2019                        | 97 (64, 151) | 0.04 | 0.68 (0.60-0.75) | 0.30 |
| 2020                        | 97 (64, 151) | 0.04 | 0.68 (0.60-0.75) | 0.30 |

IRR: incident rate ratio; CI: confidence interval; NA: no assessment. IRR is for 2020 versus 2019.
### Table 2. The number of emergency patients registered in the Osaka Emergency Information Research Intelligent Operation Network system.

|       | January | February | March | April | May | June | July | August | September | October | November | December | Total |
|-------|---------|----------|-------|-------|-----|------|------|--------|-----------|---------|----------|----------|-------|
| **Total** |         |          |       |       |     |      |      |        |           |         |          |          |       |
| 2019  | 47,897  | 37,403   | 39,622| 39,842| 40,410| 39,615| 43,083| 46,434 | 41,046    | 40,420  | 40,236   | 44,186   | 500,194|
| 2020  | 44,330  | 37,793   | 36,038| 30,898| 31,844| 34,371| 37,955| 42,898 | 36,593    | 37,479  | 35,873   | 37,249   | 443,321|
| IRR   | 0.93    | 1.01     | 0.91  | 0.78  | 0.79 | 0.87 | 0.88 | 0.92   | 0.89      | 0.93    | 0.89     | 0.84     | 0.89   |
| (95% CI) | (0.91–0.94) | (1.00–1.03) | (0.90–0.92) | (0.76–0.79) | (0.78–0.80) | (0.86–0.88) | (0.87–0.89) | (0.91–0.94) | (0.88–0.90) | (0.91–0.94) | (0.88–0.90) | (0.83–0.85) | (0.88–0.89) |
| **Children** |         |          |       |       |     |      |      |        |           |         |          |          |       |
| 2019  | 5,108   | 3,603    | 3,957 | 4,406 | 4,565| 4,817| 4,533| 4,516  | 4,269     | 3,883   | 3,699    | 4,429    | 52,065|
| 2020  | 4,199   | 3,215    | 2,766 | 2,267 | 2,293| 2,686| 3,186| 3,286  | 2,949     | 3,081   | 2,945    | 3,534    | 35,534|
| IRR   | 0.82    | 0.89     | 0.70  | 0.51  | 0.50 | 0.56 | 0.66 | 0.73   | 0.69       | 0.79    | 0.80     | 0.60     | 0.68   |
| (95% CI) | (0.79–0.86) | (0.85–0.94) | (0.67–0.74) | (0.49–0.54) | (0.48–0.53) | (0.53–0.58) | (0.63–0.69) | (0.70–0.76) | (0.66–0.72) | (0.76–0.83) | (0.76–0.84) | (0.57–0.63) | (0.67–0.69) |
| **Adults** |         |          |       |       |     |      |      |        |           |         |          |          |       |
| 2019  | 13,925  | 11,519   | 12,824| 12,782| 13,142| 14,689| 16,034| 13,762 | 12,478    | 13,890  | 14,278   | 161,525  | 142,209|
| 2020  | 13,441  | 11,635   | 11,647| 10,034| 10,534| 13,243| 14,640| 11,948 | 10,890    | 10,683  | 10,663   | 142,099  | 136,525|
| IRR   | 0.97    | 1.01     | 0.91  | 0.79  | 0.80 | 0.88 | 0.90 | 0.91   | 0.87       | 0.89    | 0.87     | 0.77     | 0.86   |
| (95% CI) | (0.94–0.99) | (0.98–1.04) | (0.89–0.93) | (0.76–0.81) | (0.78–0.82) | (0.86–0.91) | (0.88–0.92) | (0.89–0.93) | (0.85–0.89) | (0.87–0.91) | (0.85–0.90) | (0.75–0.79) | (0.87–0.89) |
| **Elderlies** |         |          |       |       |     |      |      |        |           |         |          |          |       |
| 2019  | 28,864  | 22,261   | 22,861| 22,654| 22,729| 21,656| 23,561| 25,884 | 23,015    | 23,173  | 24,059   | 25,687   | 286,604|
| 2020  | 26,690  | 22,943   | 21,625| 18,597| 19,017| 20,032| 21,526| 24,972 | 21,696    | 22,507  | 22,438   | 265,578  | 265,578|
| IRR   | 0.92    | 1.03     | 0.95  | 0.82  | 0.84 | 0.93 | 0.91 | 0.96   | 0.94       | 0.97    | 0.92     | 0.93     | 0.93   |
| (95% CI) | (0.91–0.94) | (1.01–1.05) | (0.93–0.96) | (0.81–0.84) | (0.82–0.85) | (0.91–0.94) | (0.90–0.93) | (0.95–0.98) | (0.93–0.96) | (0.95–0.99) | (0.90–0.93) | (0.91–0.94) | (0.92–0.93) |
| p-value | 0.00    | 0.00     | 0.00  | 0.00  | 0.00 | 0.00 | 0.00 | 0.00   | 0.00       | 0.00    | 0.00     | 0.00     | 0.00   |
Table 3. The number of deaths among hospitalized emergency patients registered in the Osaka Emergency Information Research Intelligent Operation Network system.

| Reason for Ambulance Call | January | February | March | April | May | June | July | August | September | October | November | December | Total |
|---------------------------|---------|----------|-------|-------|-----|------|------|--------|-----------|---------|----------|----------|-------|
| Acute disease             | NA      | NA       | NA    | NA    | NA  | NA   | NA   | NA     | NA        | NA      | NA       | NA       | NA    |
| IRR (95% CI)              | NA      | NA       | NA    | NA    | NA  | NA   | NA   | NA     | NA        | NA      | NA       | NA       | NA    |
| p-value                   | NA      | NA       | NA    | NA    | NA  | NA   | NA   | NA     | NA        | NA      | NA       | NA       | NA    |
| Disease and injury due to ship, or accident | NA      | NA       | NA    | NA    | NA  | NA   | NA   | NA     | NA        | NA      | NA       | NA       | NA    |
| IRR (95% CI)              | NA      | NA       | NA    | NA    | NA  | NA   | NA   | NA     | NA        | NA      | NA       | NA       | NA    |
| p-value                   | NA      | NA       | NA    | NA    | NA  | NA   | NA   | NA     | NA        | NA      | NA       | NA       | NA    |
| Fire accident             | NA      | NA       | NA    | NA    | NA  | NA   | NA   | NA     | NA        | NA      | NA       | NA       | NA    |
| IRR (95% CI)              | NA      | NA       | NA    | NA    | NA  | NA   | NA   | NA     | NA        | NA      | NA       | NA       | NA    |
| p-value                   | NA      | NA       | NA    | NA    | NA  | NA   | NA   | NA     | NA        | NA      | NA       | NA       | NA    |
| Injury, poisoning, and industrial accident | NA      | NA       | NA    | NA    | NA  | NA   | NA   | NA     | NA        | NA      | NA       | NA       | NA    |
| IRR (95% CI)              | NA      | NA       | NA    | NA    | NA  | NA   | NA   | NA     | NA        | NA      | NA       | NA       | NA    |
| p-value                   | NA      | NA       | NA    | NA    | NA  | NA   | NA   | NA     | NA        | NA      | NA       | NA       | NA    |
| Natural disaster          | NA      | NA       | NA    | NA    | NA  | NA   | NA   | NA     | NA        | NA      | NA       | NA       | NA    |
| IRR (95% CI)              | NA      | NA       | NA    | NA    | NA  | NA   | NA   | NA     | NA        | NA      | NA       | NA       | NA    |
| p-value                   | NA      | NA       | NA    | NA    | NA  | NA   | NA   | NA     | NA        | NA      | NA       | NA       | NA    |
| Other injury              | NA      | NA       | NA    | NA    | NA  | NA   | NA   | NA     | NA        | NA      | NA       | NA       | NA    |
| IRR (95% CI)              | NA      | NA       | NA    | NA    | NA  | NA   | NA   | NA     | NA        | NA      | NA       | NA       | NA    |
| p-value                   | NA      | NA       | NA    | NA    | NA  | NA   | NA   | NA     | NA        | NA      | NA       | NA       | NA    |
| Self-induced injury       | NA      | NA       | NA    | NA    | NA  | NA   | NA   | NA     | NA        | NA      | NA       | NA       | NA    |
| IRR (95% CI)              | NA      | NA       | NA    | NA    | NA  | NA   | NA   | NA     | NA        | NA      | NA       | NA       | NA    |
| p-value                   | NA      | NA       | NA    | NA    | NA  | NA   | NA   | NA     | NA        | NA      | NA       | NA       | NA    |
| Traffic accident involving car, ship, or aircraft | NA      | NA       | NA    | NA    | NA  | NA   | NA   | NA     | NA        | NA      | NA       | NA       | NA    |
| IRR (95% CI)              | NA      | NA       | NA    | NA    | NA  | NA   | NA   | NA     | NA        | NA      | NA       | NA       | NA    |
| p-value                   | NA      | NA       | NA    | NA    | NA  | NA   | NA   | NA     | NA        | NA      | NA       | NA       | NA    |
| Trauma due to assault     | NA      | NA       | NA    | NA    | NA  | NA   | NA   | NA     | NA        | NA      | NA       | NA       | NA    |
| IRR (95% CI)              | NA      | NA       | NA    | NA    | NA  | NA   | NA   | NA     | NA        | NA      | NA       | NA       | NA    |
| p-value                   | NA      | NA       | NA    | NA    | NA  | NA   | NA   | NA     | NA        | NA      | NA       | NA       | NA    |
| Water accident            | NA      | NA       | NA    | NA    | NA  | NA   | NA   | NA     | NA        | NA      | NA       | NA       | NA    |
| IRR (95% CI)              | NA      | NA       | NA    | NA    | NA  | NA   | NA   | NA     | NA        | NA      | NA       | NA       | NA    |
| p-value                   | NA      | NA       | NA    | NA    | NA  | NA   | NA   | NA     | NA        | NA      | NA       | NA       | NA    |

IRR: incident rate ratio; CI: confidence interval; NA: no assessment. IRR is for 2020 versus 2019.
Table 4. The number of deaths among hospitalized emergency patients registered in the Osaka Emergency Information Research Intelligent Operation Network system.

|                | January | February | March | April | May | June | July | August | September | October | November | December | Total  |
|----------------|---------|----------|-------|-------|-----|------|------|--------|-----------|---------|----------|----------|--------|
| **Total**      |         |          |       |       |     |      |      |        |           |         |          |          |        |
| 2019           | 1325    | 1018     | 1006  | 961   | 901 | 847  | 890  | 984    | 1096      | 1168    | 11,931   |          |        |
| 2020           | 1251    | 1070     | 1058  | 957   | 898 | 839  | 870  | 915    | 1062      | 1237    | 11,963   |          |        |
| IRR (95% CI)   | 0.94    | 1.05     | 1.05  | 0.95  | 0.97| 1.04 | 0.97 | 1.08   | 0.98      | 0.99    | 1.06     | 1.00     |        |
| p-value        | 0.14    | 0.26     | 0.25  | 0.26  | 0.50| 0.45 | 0.46 | 0.11   | 0.09      | 0.46    | 0.16     | 0.84     |        |
| **Children**   |         |          |       |       |     |      |      |        |           |         |          |          |        |
| 2019           | 9       | 2        | 4     | 7     | 3  | 5    | 8    | 5      | 4         | 3       | 3        | 58       |        |
| 2020           | 5       | 8        | 4     | 3     | 1  | 2    | 3    | 2      | 3         | 4       | 2        | 47       |        |
| IRR (95% CI)   | 0.56    | 4.00     | 0.80  | 0.43  | 0.33| 0.40 | 0.38 | 0.40   | 0.60      | 1.00    | 0.67     | 3.33     | 0.86   |
| p-value        | 0.30    | 0.07     | 1.00  | 0.23  | 0.38| 0.29 | 0.15 | 0.29   | 0.51      | 1.00    | 0.69     | 0.06     | 0.29   |
| **Adults**     |         |          |       |       |     |      |      |        |           |         |          |          |        |
| 2019           | 173     | 115      | 123  | 122   | 110| 105  | 119  | 108    | 107       | 146     | 149      | 165      | 1542   |
| 2020           | 156     | 113      | 115  | 126   | 94 | 112  | 139  | 132    | 110       | 136     | 133      | 144      | 1510   |
| IRR (95% CI)   | 0.90    | 0.98     | 0.95  | 1.03  | 0.85| 1.07 | 1.17 | 1.22   | 1.03      | 0.93    | 0.89     | 0.87     | 0.96   |
| p-value        | 0.35    | 0.89     | 0.60  | 0.80  | 0.26| 0.64 | 0.21 | 0.12   | 0.55      | 0.34    | 0.23     | 0.56     |        |
| **Elderlies**  |         |          |       |       |     |      |      |        |           |         |          |          |        |
| 2019           | 1143    | 901      | 879  | 832   | 814| 698  | 774  | 734    | 783       | 839    | 927      | 1083     | 10,406 |
| 2020           | 1090    | 949      | 939  | 783   | 803| 725  | 728  | 781    | 759       | 839    | 927      | 1083     | 10,331 |
| IRR (95% CI)   | 0.95    | 1.05     | 1.07  | 0.94  | 0.99| 1.04 | 0.94 | 1.06   | 0.98      | 1.01    | 0.98     | 1.08     | 1.03   |
| p-value        | 0.05    | 0.26     | 0.26  | 0.22  | 0.78| 0.47 | 0.24 | 0.23   | 0.63      | 0.90    | 0.69     | 0.07     | 0.60   |

IRR: incident rate ratio; CI: confidence interval; NA: no assessment. IRR is for 2020 versus 2019.
3.3. Subgroup Analyses by Age Groups among Patients with Acute Disease

Table 5 shows the number of emergency patients due to acute disease by age group and the IRR (95% CI) for each month during the study period. The number of paediatric patients transported by ambulance during the study period significantly decreased (30,961 patients in 2019 vs. 18,929 patients in 2020; IRR: 0.61, 95% CI: 0.60–0.62). The number of adult patients transported by ambulance also significantly decreased (107,634 patients in 2019 vs. 95,355 patients in 2020; IRR: 0.89, 95% CI: 0.88–0.89), as did that of the elderly patients transported by ambulance (202,620 patients in 2019 vs. 186,218 patients in 2020; IRR: 0.92, 95% CI: 0.92–0.93).

Table 6 shows the number of deaths of emergency patients admitted to hospital due to acute disease by age group and IRR (95% CI) for each month. The number of deaths among emergency paediatric patients admitted to hospital due to acute disease was 26 in 2019 and 25 in 2020 (IRR: 0.96, 95% CI: 0.53–1.73). The number of deaths among emergency adult patients admitted to hospital due to acute disease was 1210 in 2019 and 1171 in 2020 (IRR: 0.97, 95% CI: 0.89–1.05), and that among emergency elderly patients admitted to hospital due to acute disease was 8591 in 2019 and 8660 in 2020 (IRR: 1.01, 95% CI: 0.98–1.04). No statistically significant differences were identified between 2019 and 2020 for each month or by age group.
### Table 5. The number of emergency patients for acute disease registered in the Osaka Emergency Information Research Intelligent Operation Network system.

| Acute Disease | January | February | March | April | May | June | July | August | September | October | November | December | Total |
|---------------|---------|----------|-------|-------|-----|------|------|--------|-----------|---------|----------|----------|-------|
| **Children**  |         |          |       |       |     |      |      |        |            |         |          |          |       |
| 2019          | 3629    | 2273     | 2219  | 2451  | 2922| 2892 | 2776 | 2395   | 2089      | 1948    | 1411     | 1334     | 30,961|
| 2020          | 2837    | 1971     | 1500  | 1161  | 1027| 1321 | 1816 | 1463   | 1411      | 1334    | 18,929   | 16,507   | 107,634|
| **IRR (95% CI)** | (0.74–0.82) | (0.82–0.92) | (0.63–0.72) | (0.44–0.51) | (0.37–0.43) | (0.42–0.48) | (0.54–0.61) | (0.62–0.69) | (0.56–0.64) | (0.65–0.75) | (0.68–0.78) | (0.45–0.51) | (0.60–0.62) |
| **Adults**    |         |          |       |       |     |      |      |        |            |         |          |          |       |
| 2019          | 9748    | 7669     | 8368  | 8266  | 8718| 9898 | 9180 | 8649   | 8033      | 9133    | 16,507   | 17,593   | 202,060|
| 2020          | 9235    | 7669     | 7633  | 7025  | 7233| 7881 | 10,421| 7999   | 7088      | 7735    | 186,218  | 186,218  | 95,355 |
| **IRR (95% CI)** | (0.92–0.97) | (0.97–1.04) | (0.88–0.94) | (0.82–0.88) | (0.80–0.86) | (0.86–0.91) | (0.88–0.93) | (0.91–0.96) | (0.85–0.90) | (0.85–0.91) | (0.72–0.86) | (0.88–0.89) |       |
| **Elders**    |         |          |       |       |     |      |      |        |            |         |          |          |       |
| 2019          | 20,862  | 15,840   | 15,957| 15,653| 16,214|15,415|16,765|18,926  | 16,385     | 15,943  | 16,507   | 17,593   | 202,060|
| 2020          | 18,785  | 16,023   | 15,091| 13,177| 13,500|14,145|15,040|18,419  | 15,356     | 15,369  | 16,507   | 17,593   | 186,218|
| **IRR (95% CI)** | (0.88–0.92) | (0.99–1.03) | (0.92–0.97) | (0.82–0.86) | (0.81–0.85) | (0.90–0.94) | (0.88–0.92) | (0.95–0.99) | (0.92–0.96) | (0.94–0.99) | (0.89–0.93) | (0.90–0.94) | (0.92–0.93) |

IRR: incident rate ratio; CI: confidence interval; NA: not assessment.

### Table 6. The number of deaths among hospitalized emergency patients for acute disease registered in the Osaka Emergency Information Research Intelligent Operation Network system.

| Reason for Ambulance Call | January | February | March | April | May | June | July | August | September | October | November | December | Total |
|---------------------------|---------|----------|-------|-------|-----|------|------|--------|-----------|---------|----------|----------|-------|
| **Children**              |         |          |       |       |     |      |      |        |            |         |          |          |       |
| 2019                      | 4       | 2        | 1     | 2     | 3  | 2    | 3    | 3       | 2         | 0       | 2        | 7        | 26    |
| 2020                      | 4       | 2        | 3     | 3     | 3  | 2    | 3    | 3       | 2         | 0       | 2        | 7        | 25    |
| **IRR (95% CI)**          | (0.19–0.57) | (0.07–1.80) | (0.10–117.99) | (0.07–13.80) | (0.01–6.90) | (0.06–6.82) | (0.01–9.60) | (0.01–14.15) | (0.01–9.60) | NA      | (0.07–34.53) | (0.53–1.73) |       |
| **Adults**                |         |          |       |       |     |      |      |        |            |         |          |          |       |
| 2019                      | 143     | 107      | 107   | 79    | 88  | 88   | 81   | 92      | 106       | 117     | 129      | 1210     | 1210  |
| 2020                      | 124     | 88       | 95    | 75    | 90  | 108  | 84   | 95      | 106       | 116     | 118      | 1171     | 1171  |
| **IRR (95% CI)**          | (0.68–1.11) | (0.79–1.46) | (0.61–1.10) | (0.74–1.33) | (0.68–1.32) | (0.75–1.39) | (0.92–1.65) | (0.67–1.24) | (0.67–1.19) | (0.69–1.16) | (0.89–1.10) | (0.89–1.10) |       |
| **Elders**                |         |          |       |       |     |      |      |        |            |         |          |          |       |
| 2019                      | 965     | 743      | 762   | 672   | 686 | 644  | 615  | 660     | 767       | 891     | 8591     | 8591     | 8591  |
| 2020                      | 900     | 821      | 792   | 659   | 672 | 603  | 608  | 622     | 704       | 891     | 8660     | 8660     | 8660  |
| **IRR (95% CI)**          | (0.85–1.02) | (1.00–1.22) | (0.94–1.15) | (0.88–1.09) | (0.88–1.09) | (0.93–1.17) | (0.87–1.09) | (0.90–1.13) | (0.84–1.05) | (0.89–1.15) | (0.87–1.13) | (0.88–1.07) | (0.98–1.04) |

IRR: incident rate ratio; CI: confidence interval; NA: not assessment.
4. Discussion

In this study, we used data from a large population-based patient registry to determine the number of emergency patients and the number of deaths among these patients admitted to hospital in the COVID-19 pandemic during 2020 in Osaka Prefecture. Although the number of emergency patients decreased in 2020 compared with 2019, the number of deaths among the emergency patients admitted to hospital in 2020 was similar to that in 2019. The results of this study, which used population-based data to reveal the impact of an emerging infectious disease pandemic on the EMS system, could be useful to plan health care systems and policies.

The number of emergency patients decreased in 2020 compared with 2019, especially in April, May, and December. As well, the number of emergency patients due to acute disease as the reason for the ambulance call also decreased, especially in April, May, and December. A previous study in Venice, northern Italy, comparing the number of ambulance dispatches in 2019 and 2020, found that the COVID-19 pandemic reduced the number of ambulance dispatches in 2020 [14]. It was also reported that the number of emergency department visits decreased during the severe acute respiratory syndrome (SARS) pandemic that spread in 2003 [15–19]. Thus, when an infectious disease spreads throughout a city or society, the number of emergency department visits may decrease as a result of people buying medicines from pharmacies for their own care and refraining from visiting the emergency department. In contrast, in Seine-Saint-Denis, which is a French department bordering Paris to the northeast and is a part of Greater Paris, Lapostolle et al. reported that the COVID-19 pandemic increased the number of calls for the Service d’Aide Medicale Urgente (SAMU) and the number of emergency department visits compared to the average of the previous five years [20]. The SAMU in France provides several medical services such as medical advice and hospital transfer by a non-emergency transport ambulance. Contrastingly, the only service provided by the EMS system in Japan is ambulance dispatch, and the differences in services provided by the SAMU in France versus the EMS system in Japan may have affected the difference in results. Further, Saberian et al. reported an increase in the number of EMS calls and ambulance dispatches after the first COVID-19 patient was identified on 18 February 2020 in Tehran, Iran [21]. The EMS system in Iran is similar to that in Japan in that the EMS personnel evaluate the patient at the scene and, if necessary, transport the patient to a hospital. The difference of results between the study in Japan and that in Iran, which operates a similar EMS system, may be due to the fact that Japanese people who used to call an ambulance even in cases not necessarily requiring an ambulance are now discouraged from visiting hospitals and clinics due to the risk of COVID-19.

The number of emergency patients due to sports injuries, industrial accidents, and traffic accidents also decreased in 2020 compared to 2019. In Japan, the Japanese government requested temporary closures of elementary, junior high, and high schools on 2 March 2020 [22], and the temporary closure of these schools continued until 31 May 2020 in Osaka Prefecture. In addition, many sports gyms have refrained from operating as a result of COVID-19 outbreaks in some of these gyms. As a result of this reduction in opportunities for sports in schools and gyms, the number of emergency patients due to sports injuries would likely have decreased. In Japan, although no explicit lockdown measures were taken by the government, the number of emergency patients due to traffic accidents and industrial accidents may have also decreased because of the slowdown in socioeconomic activity due to the voluntary restraint of various companies. Subgroup analyses by age group showed a decrease in patients transported by ambulance among children starting in January and a decrease in patients transported by ambulance among adults and the elderly after March. This result may be due to parents being less likely to visit the emergency department due to vigilance against an unknown infectious disease. In addition, as a result of school closures, they may not have visited emergency departments as a result of fewer cases of seasonal influenza in their children.
There was no change in the number of deaths of emergency patients admitted to hospital in 2020 compared with 2019. There were also no differences in the number of deaths of emergency patients admitted to hospital in the analyses by reason for ambulance call or by age group. Indeed, several previous studies have reported that COVID-19 outbreaks have reduced emergency patients due to influenza and mortality due to other infectious diseases [23,24]. On the other hand, there were concerns that other acute illnesses might affect the prognosis of emergency elderly patients due to an increase in demand for medical care. However, no impact on their prognosis was identified in this study because the health care system and EMS system functioned effectively for the community as a whole. To maintain the level of medical treatment in future surges of the COVID-19 pandemic and other infectious disease pandemics, it will be necessary to establish a medical and health care system with a clear role for medical institutions.

This study has several limitations. First, although all fire departments and emergency medical institutions in Osaka Prefecture registered ambulance records and patient data in the ORION registry, the prognosis of patients transported to medical institutions outside Osaka Prefecture or by fire departments outside Osaka Prefecture is unknown. Second, no information was available on the detailed treatment of the patients in hospital that would have affected death after hospital admission. Third, although this study was analysed by reason for ambulance call, a detailed analysis of the impact of the COVID-19 pandemic on the EMS system by disease, such as out-of-hospital cardiac arrest, acute coronary syndrome, and pneumonia, will be performed and reported in the near future. Fourth, as we included the emergency patients in this study, the impact of the COVID-19 pandemic on all causes of death in Osaka was unknown. Fifth, we did not include the deaths in the emergency department in this study. Many of the patients who died in the emergency department were the patients with out-of-hospital cardiopulmonary arrest. Prehospital factors such as bystander cardiopulmonary resuscitation can affect the outcomes of patients with out-of-hospital cardiopulmonary arrest. Therefore, we did not include these patients in this study.

5. Conclusions

In Osaka Prefecture, Japan, the incidence of emergency patients transported by ambulance decreased during the COVID-19 pandemic in 2020, but the mortality of emergency patients admitted to hospital did not change. The impact of the COVID-19 pandemic on the EMS system will need to be monitored over the long term.

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Institutional Review Board Statement: This study was approved by the Ethics Committee of Osaka University Graduate School of Medicine (approval no. 15003). In addition, this manuscript was written based on the STROBE statement to assess the reporting of cohort and cross-sectional studies. All methods in this study were carried out in accordance with the declaration of Helsinki.

Informed Consent Statement: ORION data are considered administrative records and the ORION data are anonymized without specific personal data, such as patient name, date of birth, and address. Therefore, the requirement of obtaining patient informed consent was waived.

Data Availability Statement: The data that support the findings of this study are available from the Osaka Prefectural government, but the availability of these data is restricted. Data cannot be shared publicly because of the Protection Ordinance for Personal Information in Osaka Prefecture. Data
may be applied for if a qualified researcher applies for the data and the research is approved by the technical committee (http://www.pref.osaka.lg.jp/iryo/qq/orion_teikyo.html, accessed on 1 November 2021), in Japanese).

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References

1. Ministry of Health, Labour and Welfare. The Open Dataset of Patients with COVID-19. Available online: https://www.mhlw.go.jp/stf/covid-19/open-data-info.html (accessed on 16 June 2021). (In Japanese)
2. Huang, C.; Wang, Y.; Li, X.; Ren, L.; Zhao, J.; Hu, Y.; Zhang, L.; Fan, G.; Xu, J.; Gu, X.; et al. Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China. Lancet 2020, 395, 497–506. [CrossRef]
3. Rodriguez-Morales, A.J.; Cardona-Ospina, J.A.; Gutiérrez-Ocampo, E.; Villamizar-Peña, R.; Holguín-Rivera, Y.; Escalera-Anteazana, J.P.; Alvarado-Arnez, L.E.; Bonilla-Aldana, D.K.; Franco-Paredes, C.; Henao-Martinez, A.F.; et al. Clinical, laboratory and imaging features of COVID-19: A systematic review and meta-analysis. Travel Med. Infect. Dis. 2020, 34, 101623. [CrossRef] [PubMed]
4. Prezant, D.J.; Zeig-Owens, R.; Schwartz, T.; Liu, Y.; Hurwitz, K.; Beecher, S.; Weiden, M.D. Medical Leave Associated With COVID-19 Among Emergency Medical System Responders and Firefighters in New York City. JAMA Netw. Open 2020, 3, e201694. [CrossRef] [PubMed]
5. Katayama, Y.; Kitamura, T.; Kiyohara, K.; Iwami, T.; Kawamura, T.; Hayashida, S.; Yoshiya, K.; Ogura, H.; Shimazu, T. Factors associated with the difficulty in hospital acceptance at the scene by emergency medical service personnel: A population-based study in Osaka City, Japan. BMJ Open 2016, 6, e013849. [CrossRef] [PubMed]
6. Okamoto, J.; Katayama, Y.; Kitamura, T.; Sado, J.; Nakamura, R.; Kimura, N.; Misaki, H.; Yamao, S.; Nakao, S.; Nitta, M.; et al. Profile of the ORION (Osaka emergency information Research Intelligent Operation Network system) between 2015 and 2016 in Osaka, Japan: A population-based registry of emergency patients with both ambulance and in-hospital records. Acute Med. Surg. 2019, 6, 12–24. [CrossRef] [PubMed]
7. Takeuchi, T.; Imanaka, T.; Katayama, Y.; Kitamura, T.; Sobue, T.; Shimazu, T. Profile of patients with novel coronavirus disease 2019 (COVID-19) in Osaka Prefecture, Japan: A population-based descriptive study. J. Clin. Med. 2020, 9, 2925. [CrossRef]
8. Ministry of Health, Labour and Welfare. The Treatment Guidelines about COVID-19. Available online: https://www.mhlw.go.jp/content/000631552.pdf (accessed on 24 November 2020). (In Japanese)
9. Osaka Prefectural Government. The Open Data about COVID-19. Available online: https://covid19-osaka.info/ (accessed on 17 June 2021). (In Japanese)
10. Osaka Prefectural Government. Estimated Population of Osaka Prefecture in 2019. Available online: http://www.pref.osaka.lg.jp/attach/3387/0014731/R1nempou.pdf (accessed on 17 June 2021). (In Japanese)
11. von Elm, E.; Altman, D.G.; Egger, M.; Pocock, S.J.; Gotzsche, P.C.; Vandebroucke, J.P. The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement: Guidelines for reporting observational studies. Lancet 2007, 370, 1453–1457. [CrossRef]
12. Stella, F.; Alexopoulos, C.; Scquizzato, T.; Zorzi, A. Impact of the COVID-19 outbreak on emergency medical system missions and emergency department visits in the Venice area. Eur. J. Emerg. Med. 2020, 27, 298–300. [CrossRef] [PubMed]
13. Man, C.Y.; Yeung, R.S.; Chung, J.Y.; Cameron, P. Impact of SARS on an emergency department in Hong Kong. Emerg. Med. 2003, 15, 418–422. [CrossRef] [PubMed]
14. Ko, P.C.-I. Emergency Medical Services Utilization during an Outbreak of Severe Acute Respiratory Syndrome (SARS) and the Incidence of SARS-associated Coronavirus Infection among Emergency Medical Technicians. Acad. Emerg. Med. 2004, 11, 903–911. [CrossRef] [PubMed]
15. Tsai, M.C.; Arnold, J.J.; Chuang, C.C.; Chi, C.H.; Liu, C.C.; Yang, Y.J. Impact of an outbreak of severe acute respiratory syndrome on a hospital in Taiwan, ROC. Emerg. Med. J. 2004, 21, 311–316. [CrossRef]
16. Huang, C.-C.; Yen, D.H.-T.; Huang, H.-H.; Kao, W.-F.; Wang, L.-M.; Huang, C.-I.; Lee, C.-H. Impact of Severe Acute Respiratory Syndrome (SARS) Outbreaks on the Use of Emergency Department Medical Resources. J. Chin. Med. Assoc. 2005, 68, 254–259. [CrossRef]
19. Huang, H.-H.; Yen, D.H.-T.; Kao, W.-F.; Wang, L.-M.; Huang, C.-I.; Lee, C.-H. Declining Emergency Department Visits and Costs during the Severe Acute Respiratory Syndrome (SARS) Outbreak. *J. Formos. Med. Assoc.* 2006, 105, 31–37. [CrossRef]

20. Lapostolle, F.; Goix, L.; Vianu, I.; Chanzy, E.; De Stefano, C.; Gorlicki, J.; Petrovic, T.; Adnet, F. COVID-19 epidemic in the Seine-Saint-Denis Department of Greater Paris: One month and three waves for a tsunami. *Eur. J. Emerg. Med.* 2020, 27, 274–278. [CrossRef] [PubMed]

21. Saberian, P.; Conovaloff, J.L.; Vahidi, E.; Hasani-Sharamin, P.; Kolivand, P.-H. How the COVID-19 Epidemic Affected Prehospital Emergency Medical Services in Tehran, Iran. *West. J. Emerg. Med.* 2020, 21, 110–116. [CrossRef] [PubMed]

22. Prime Minister’s Office of Japan. The Minutes of 15th Headquarters Meeting on COVID-19. Available online: https://www.kantei.go.jp/jp/98_abe/actions/202002/27corona.html (accessed on 17 June 2021). (In Japanese)

23. Hirose, T.; Katayama, Y.; Tanaka, K.; Kitamura, T.; Nakao, S.; Tachino, J.; Nakao, S.; Nitta, M.; Iwami, T.; Fujimi, S.; et al. Reduction of Influenza in Osaka, Japan During the COVID-19 Outbreak: A Population-based ORION Registry Study. *IJID Reg.* 2021, 1, 79–81. [CrossRef]

24. Yorifuji, T.; Matsumoto, N.; Takao, S. Excess All-Cause Mortality during the COVID-19 Outbreak in Japan. *J. Epidemiol.* 2021, 31, 90–92. [CrossRef] [PubMed]