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LETTER TO THE EDITOR

# Characteristics of COVID-19 in multicenter ICUs in Japan

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To the Editor:

Several studies have evaluated multicenter epidemiology and outcomes for patients with COVID-19 in intensive care units (ICUs), with reported mortality ranging widely—from 31 to 58% (references S1–S8 in Online Resources 2). In Japan, only one single-center study has described the epidemiology of COVID-19 patients in the ICU [1], and no multicenter studies have been conducted. Therefore, this study aimed to describe the characteristics and outcomes of patients with COVID-19 who were admitted to multicenter ICUs in Japan.

This was a multicenter retrospective cohort study conducted in Japan. We used data from the Japanese Intensive care PAtient Database (JIPAD), a national ICU registry established by the Japanese Society of Intensive Care Medicine [2]. We included all ICU patients aged ≥ 16 years who were admitted with COVID-19 in the JIPAD from January 1, 2020, to February 28, 2021. The study population is described in more detail in Online Resources 1. The primary outcome was in-hospital mortality. We describe the patients' characteristics and outcomes with stratification by age group and organ support therapies during the ICU stay.

We identified 451 patients from 40 ICUs during the study period. The median age was 68 years (interquartile range: 58–74), and 104/451 (23.1%) patients were female. The median APACHE II, APACHE III, SAPS II, and SOFA scores were 16 (interquartile range: 13–21), 61 (46–80), 38 (29–46), and 6 (4–8), respectively. The overall in-hospital mortality was 70/451 (15.5%). The numbers of patients who required invasive mechanical ventilation, renal replacement therapy, and extracorporeal membrane oxygenation during the ICU stay were 331/451 (73.4%), 62/451 (13.7%), and 41/451 (9.1%), respectively. The in-hospital mortality of patients who did not receive invasive mechanical ventilation, only received invasive mechanical ventilation, received both invasive mechanical ventilation and renal replacement therapy, and received extracorporeal membrane oxygenation during the ICU stay were 13/119 (10.9%), 29/253 (11.5%), 16/38 (42.1%), and 12/41 (29.3%), respectively (Fig. 1). In-hospital mortality was less than 5% among patients aged < 65 years who did not receive invasive mechanical ventilation, patients aged < 65 years who only received invasive mechanical ventilation, and patients aged 16–54 years who received both invasive mechanical ventilation and renal replacement therapy (Fig. 1). The baseline characteristics and outcomes of the overall patient cohort and the cohort stratified by age group and organ support therapies during the ICU stay are presented in Online Resources 3–8.

The results of this study suggest that ICUs in the hospitals participating in the JIPAD treated COVID-19 patients with the same severity of illness as that observed in multicenter studies conducted outside Japan (references S1–S8 listed in Online Resources 2). The cohort in this study was about 5 years older than those in previous studies. The included severity scores (APACHE II, SAPS II, and SOFA) during the first 24 h after ICU admission in our cohort were similar or higher, compared with previous studies. The reported rates of organ support therapies including invasive mechanical ventilation, renal replacement therapy, and extracorporeal membrane oxygenation during the ICU stay were similar or higher, compared with previous studies, too. Although the severity of illness was similar between our study and previous multicenter studies in other countries, the mortality in this study was 15%–40% lower than the mortality reported in previous studies. There are several possible explanations

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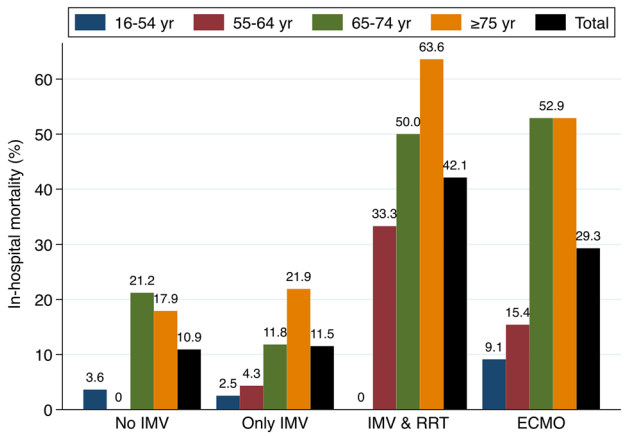


**Fig. 1** In-hospital mortality stratified by age group and organ support therapies during ICU stay. Because of the small number of patients aged ≥ 65 years who received ECMO, in-hospital mortality for patients aged 65–74 years and ≥ 75 years were combined. *ICU* intensive care unit; *IMV* invasive mechanical ventilation; *RRT* renal replacement therapy; *ECMO* extracorporeal membrane oxygenation

for the difference in the mortality of COVID-19 patients between this study and previous studies, including differences in ICU strain, body mass index, publication year and COVID-19 treatment (details provided in Online Resource 2). Further international evaluations are required to investigate the cause of this mortality difference.

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**Author contributions** HO, HE, JK, SU, SH, and HY conceived and designed the study. HO analyzed the data, interpreted the results, and wrote the first draft of the manuscript. JK, SU, JH, KH, HI, JK, HK, TN, and MU contributed to the data collection and to ensuring data credibility. YA, EH, JH, KH, NI, HI, TK, HK, TN, HO, HS, ST, KT, and MU contributed to the interpretation of the results and to the revision of the manuscript. SH organized the JIPAD project. All authors have read and approved the final version of the manuscript and agreed to submit it.

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## Declarations

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