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# Patients With Coronavirus Disease 2019 Requiring Invasive Mechanical Ventilation in Mexico in the First, Second, and Exponential Growth Phase of the Third Wave of the Coronavirus Disease 2019 Pandemic

**ABSTRACT:** A total of 3,197,108 coronavirus disease 2019 cases (2,537 cases per 100,000 people) and 252,080 deaths (200 deaths per 100,000 people) were recorded in Mexico as of August 20, 2021. There were 36,934 of 203,582 coronavirus disease 2019 patients (18.1%) that required invasive mechanical ventilation during the first wave of coronavirus disease 2019, 24,698 of 253,899 (9.7%) patients during the second wave, and 5,610 of 65,952 (8.5%) during the exponential growth phase of the third wave ( $p < 0.001$ ). The proportion of patients who received invasive mechanical ventilation in the ICU was lower in the first wave (27.9%) and then remained between 33.3% and 36.2% for the remainder of that period. Although the inhospital mortality of hospitalized coronavirus disease 2019 patients requiring intubation during the exponential growth phase of the third wave was lower than that in the first and second waves, the inhospital mortality in coronavirus disease 2019 patients requiring invasive mechanical ventilation remained greater than 82%.

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## To the Editor:

Like other countries at the end of May 2021, Mexico began experiencing a third wave of coronavirus disease 2019 (COVID-19) hospitalizations. A total of 3,197,108 COVID-19 cases (2,537 cases per 100,000 people) and 252,080 deaths (200 deaths per 100,000 people) were recorded in Mexico as of August 20, 2021 (1). Mexico ranks fourth globally in numbers of deaths due to the pandemic, following the United States, Brazil, and India. This report aimed to compare the inhospital mortality between the first, second, and exponential growth phase of the third wave of COVID-19 patients requiring invasive mechanical ventilation (IMV) in Mexico.

This report analyzed an anonymized patient dataset publicly available to anyone through the Mexican Health Ministry, which was released on August 20, 2021 (1). In this report, the COVID-19 epidemic was divided into three periods: the first wave from February 27, 2020, to September 30, 2020; the second wave from October 1, 2020, to May 24, 2021; and the third wave from the end of May to August 20, 2021 (exponential growth phase). A total of 39,848 hospitalized COVID-19 patients requiring IMV from previous reports were included in the analysis (2, 3). All COVID-19 patients confirmed by reverse transcriptase-polymerase chain reaction, an adjudication committee, or an epidemiological association were included in the analysis. Continuous variables were expressed as median and interquartile range (IQR) values and compared using

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DOI: 10.1097/CCE.0000000000000556

the Kruskal-Wallis test. Categorical variables were described as counts and percentages and were compared using the chi-square test. A two-sided *p* value of less than 0.05 was considered statistically significant.

From February 27, 2020, to August 20, 2021, in Mexico, 523,433 confirmed COVID-19 patients were admitted to the hospital. The relationships between COVID-19 and the clinical characteristics of patients receiving IMV at any point during hospitalization are summarized in **Table 1**.

There were 36,934 of 203,582 COVID-19 patients (18.1%) that required IMV during the first wave of COVID-19, 24,698 of 253,899 (9.7%) patients during

the second wave, and 5,610 of 65,952 (8.5%) during the exponential growth phase of the third wave (*p* < 0.001). The overall median age was 60 years (IQR, 50–70), with 76% being 50 years or older and 36.3% women (Table 1). Most patients under IMV (19,524 [79.1%] of 24,698) during the second wave were 50 years old or older (Table 1). There was an increase in the proportion of younger people (0–49 yr) requiring IMV over time: 8,451 of 36,934 patients (22.9%) in the first wave, 5,174 of 24,698 patients (20.9%) in the second wave, and 2,486 of 5,610 patients (44.3%) during the exponential growing phase of the third wave (*p* < 0.001). The proportion of patients who received

**TABLE 1.**  
**Characteristics of Patients Receiving Invasive Mechanical Ventilation During Their Hospitalization During the First, Second, and Early Third Waves of the Coronavirus Disease 2019 in Mexico**

Characteristics	First Wave ( <i>n</i> = 36,934)	Second Wave ( <i>n</i> = 24,698)	Early Third Wave ( <i>n</i> = 5,610)	<i>p</i>
Age, yr, median (interquartile range)	61 (51–70)	60 (50–70)	53 (41–65)	< 0.001
Age, yr, <i>n</i> (%)				
0–49	8,451 (22.9)	5,174 (20.9)	2,486 (44.3)	< 0.001
50–64	14,038 (38.0)	9,163 (37.1)	1,695 (30.2)	
65 and older	14,445 (39.1)	10,361 (42.0)	1,429 (25.5)	
Female, <i>n</i> (%)	12,949 (35.1)	9,201 (37.3)	2,226 (39.7)	< 0.001
Male, <i>n</i> (%)	23,985 (64.9)	15,497 (62.7)	3,384 (60.3)	
Pregnant women, <i>n</i> (%)	103 (0.3)	75 (0.3)	51 (0.9)	< 0.001
Medical treatment in the public healthcare system, <i>n</i> (%)	35,599 (96.4)	22,899 (92.7)	5,231 (93.2)	< 0.001
Medical treatment in the private healthcare system, <i>n</i> (%)	1,335 (3.6)	1,799 (7.3)	379 (6.8)	
Time from illness onset to hospital admission, d, median (interquartile range)	4 (2–7)	6 (3–9)	6 (3–9)	< 0.001
Comorbidities, <i>n</i> (%)				
Hypertension	15,226 (41.2)	10,578 (42.8)	1,899 (33.9)	< 0.001
Diabetes	13,038 (35.3)	8,684 (35.2)	1,640 (29.2)	< 0.001
Obesity	9,311 (25.2)	6,496 (26.3)	1,619 (28.9)	< 0.001
Chronic kidney disease	2,079 (5.6)	1,168 (4.7)	267 (4.8)	< 0.001
Cardiovascular disease	1,738 (4.7)	1,133 (4.6)	222 (4.0)	0.044
Chronic obstructive lung disease	1,496 (4.1)	784 (3.2)	135 (2.4)	< 0.001
Immunosuppression	953 (2.6)	522 (2.1)	119 (2.1)	< 0.001
Asthma	771 (2.1)	450 (1.8)	120 (2.1)	0.050
Invasive mechanical ventilation in the ICU, <i>n</i> (%)	10,323 (27.9)	8,944 (36.2)	1,870 (33.3)	< 0.001
Invasive mechanical ventilation outside ICU, <i>n</i> (%)	26,611 (72.1)	15,754 (63.8)	3,740 (66.7)	
Inhospital mortality, <i>n</i> (%)	31,038 (84.0)	20,862 (84.5)	3,783 (67.4)	< 0.001

IMV in the ICU was lower in the first wave (27.9%) and then remained between 33.3% and 36.2% for the remainder of that period. During the first wave of the COVID-19 pandemic, 26,611 of 36,934 patients (72.1%) received IMV outside the ICU, compared with 15,754 of 24,698 patients (63.8%) and 3,740 of 5,610 patients (66.7%) in the second wave and the exponential growth phase of the third wave, respectively (Table 1). It should be noted that the mortality rate for those who did not receive IMV during hospitalization was 38.5% (175,703 of 456,191 patients) (Fig. 1). Although the inhospital mortality of hospitalized COVID-19 patients requiring intubation during the exponential growth phase of the third wave was lower than that in the first and second waves, the inhospital mortality in COVID-19 patients requiring IMV remained greater than 82% (Fig. 2).

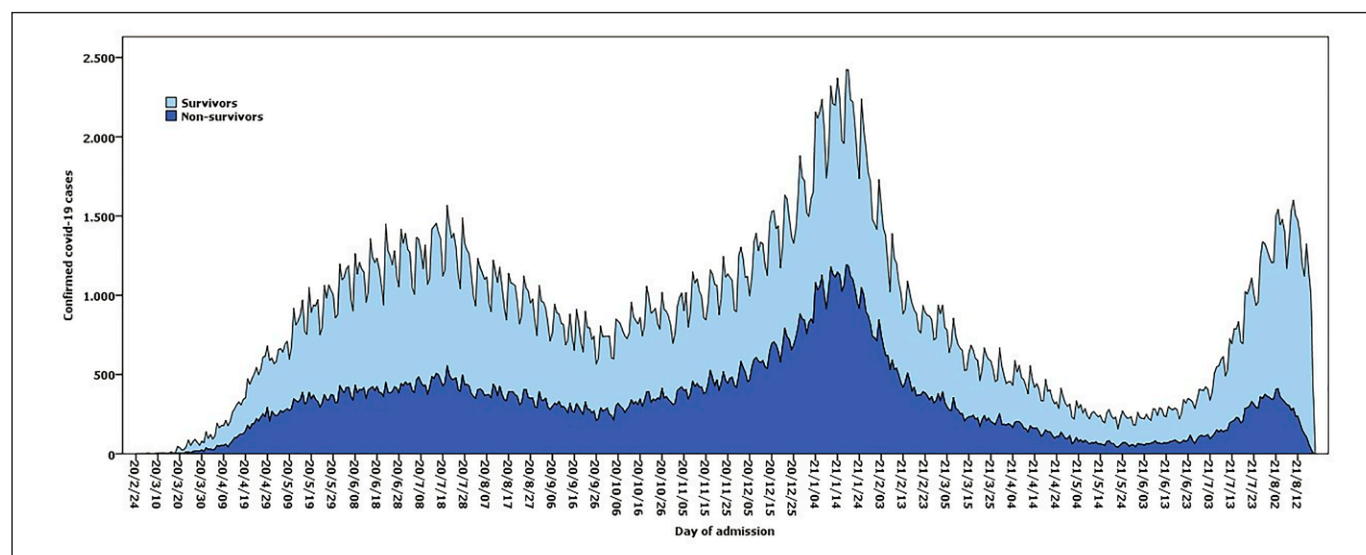
In this report, the inhospital mortality of hospitalized COVID-19 patients requiring IMV was higher than that of other countries such as Brazil (4) (81.5% vs 83.7%;  $p < 0.001$ ). Recently, Estenssoro et al (5) reported that 22% of patients who required intubation in Argentina were outside the ICU; this proportion is much lower than that presented in this report (22% vs 68.5%;  $p < 0.001$ ). In Mexico, the Secretary of Health designed a hospital reconversion system in which the work groups for the care of critically ill patients include one specialist physician as the leader of medical and nursing areas, guiding the staff with national and international guidelines for managing critically ill patients with COVID-19. In addition, telementoring was used

for centers in remote areas. In this system, one specialist could guide the care of up to 25 patients (for every five to eight patients, one consultant; for every one to two patients, one specialist and generalist nurse) (6).

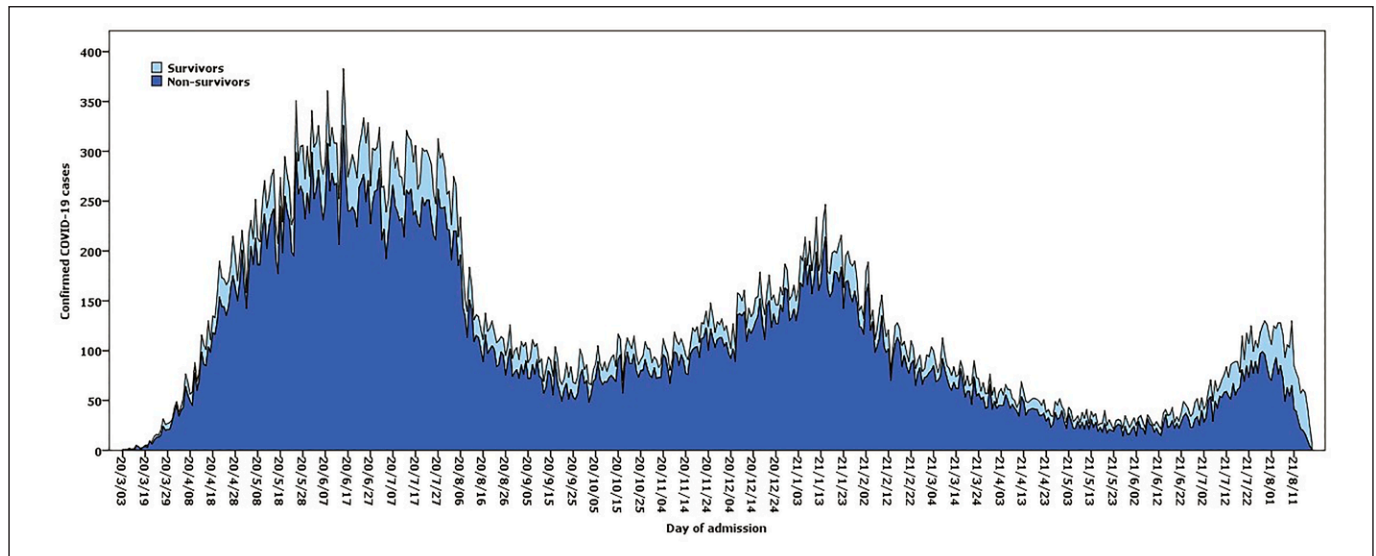
Since May 24, 2021, Mexico has imposed limited social isolation measures in the middle of the country, probably due to a sustained decrease in the number of newly confirmed COVID-19 cases and deaths, low hospital occupancy, and increased vaccine coverage. Although this was an essential step toward economic recovery, the pandemic remains out of control in several countries, including Mexico.

The delta variant of severe acute respiratory syndrome coronavirus 2 that appeared in India in December 2020 (7) is spreading in the Americas. The delta variant spreads more than two times as quickly as the original virus first detected in Wuhan, China, in 2019 (8). Health systems have been overwhelmed with no time to prepare (7). The delta variant can infect both vaccinated and unvaccinated individuals (8). In Mexico, the delta variant represents 41% of new cases in the past 60 days (9), and its rapid spread has likely caused the increased hospitalization and ICU admission rates in different Mexican cities.

The number of confirmed COVID-19 cases in Mexico has decreased over the last 40 days. As the COVID-19 pandemic cannot be controlled, Mexico should attempt to reduce the risk of transmission in the community and increase vaccination efforts. However, on August 30, 2021, millions of Mexican children returned to school in-person with a system



**Figure 1.** Epidemiological curve of confirmed coronavirus disease 2019 (COVID-19) patients who did not receive invasive mechanical ventilation during hospitalization (survivors and nonsurvivors) plotted by hospital admission date.



**Figure 2.** Epidemiological curve of the invasively ventilated patients with confirmed cases of coronavirus disease 2019 (COVID-19) (survivor and nonsurvivors) plotted by hospital admission date.

that is voluntary, diverse, and hybrid between in-person learning and virtual lessons.

Interdisciplinary and interprofessional care is the cornerstone of better patient care and better outcomes (10). Typically, the ICU has daily multidisciplinary rounds consisting of physicians, nurses, and other healthcare professionals (like social workers, respiratory therapists, and pharmacists) (10). Adequate staffing levels of different groups are crucial to allow optimal teamwork. Critical care physicians have been crucial in the pandemic. They are primarily responsible for treating patients in the ICU. In this role, intensivists lead a multidisciplinary team of physicians who are experts in different specialties, coordinating all other services the patient may need. During the first and second COVID-19 waves, the number of ICU beds or beds with ventilators in Mexico increased from 2,446 (before the COVID-19 pandemic) to 11,634 (3, 11). However, there was no growth in the number of intensivists. Many intensivists work in up to two hospital centers 7 days a week both before and during the COVID-19 pandemic. As of August 20, 2021, there are 1,139 certified specialists in critical care medicine (0.9 intensivists per 100,000 people) in Mexico (12), and hospitals with intensivists (teaching and large facilities with ICUs) tend to be in metropolitan or urban areas (Mexico City, Guadalajara, and Monterrey).

Having enough beds with ventilators provides little value without qualified, well-trained personnel to treat critically ill COVID-19 patients. Based on global and

local trends, the inhospital COVID-19 mortality in Mexico is expected to decrease in the third wave; however, the delta variant might cause more severe illness than previous strains in unvaccinated people if they are infected.

## ACKNOWLEDGMENTS

This report is dedicated to all of the patients and healthcare workers who died due to COVID-19 in Mexico and around the world. I am indebted to Dr. Mireya Barragán-Dessavre for critical readings of this article.

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Dr. Ñamendys-Silva helped in the design, data analysis, data interpretation, and writing of this report.

The author has disclosed that he does not have any potential conflicts of interest.

No ethics approval was sought for this study because this study involved the analyses of an anonymized dataset of patients that is publicly available and accessible to anyone via the Mexican Health Ministry.

Availability of data and material: [http://datosabiertos.salud.gob.mx/gobmx/salud/datos\\_abiertos/historicos/2021/08/datos\\_abiertos\\_covid19\\_20.08.2021.zip](http://datosabiertos.salud.gob.mx/gobmx/salud/datos_abiertos/historicos/2021/08/datos_abiertos_covid19_20.08.2021.zip). Accessed August 21, 2021.

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