Intensive Care Med
https://doi.org/10.1007/s00134-020-06256-3

LETTER

Hospital mortality in mechanically ventilated COVID-19 patients in Mexico

Silvio A. Ñamendys-Silva[1,2*], Alan Gutiérrez-Villaseñor[3] and Juan P. Romero-González[3]

Dear Editor,

As of August 13th, 2020, a total of 20,439,814 confirmed cases of coronavirus disease 2019 (COVID-19) have been reported to the World Health Organization, and 744,385 lives have been lost [1]. The Americas constitute the current epicentre of the COVID-19 pandemic. A total of 505,751 confirmed cases of COVID-19 and 55,293 deaths have been reported in Mexico [2], and 2.5% of these patients have required endotracheal intubation and invasive mechanical ventilation [2]. This report describes the sociodemographic characteristics and comorbidities associated with mortality in mechanically ventilated adults with COVID-19 in Mexico.

We analysed data collected in the General Epidemiology Directorate of the Mexican Ministry of Heath, which is an open-source dataset comprising of daily updated data of suspected COVID-19 cases that were confirmed by a positive test for SARS-CoV-2 [2]. We used the version released on August 13th, 2020 [2].

A total of 12,018 mechanically ventilated adults with COVID-19 were included. The flow chart of the study is shown in Figure S1 (supplemental methods). The median age was 60 years (interquartile range 50–69; range 18–108 years), and 7971 (66.3%) were men (Figure S2) (supplementary material). The sociodemographic characteristics and comorbidities of the patients with COVID-19 (according to in-hospital deaths) are shown in Table 1. A total of 57.6% ($n=6928$) of the patients were mechanically ventilated outside of the intensive care units (Figure S1) (supplementary material). The overall in-hospital mortality was 73.7% ($n=8861$).

In our report, hospital mortality was higher than mortality in high-income countries such as the United Kingdom (67.4% versus 73.7%, $p<0.001$) [3] and Germany (53% versus 73.7%, $p<0.001$) [4]. Furthermore, hospitalisation in the public healthcare system presented higher crude mortality compared with the private healthcare system (Figure S3) (supplementary material).

Mexican health authorities have stated that the response to the pandemic has been satisfactory because the health system has not been affected and because sufficient numbers of beds with ventilators are available. As shown in this report, the availability of sufficient numbers of beds with ventilators does not ensure improvement in the prognoses of patients with COVID-19. Beyond the quantity of beds with ventilators, there may also be concerns about the quality of care, as has been suggested by the high mortality rate for intubated COVID-19 patients in Mexico. Health care systems in low- and middle-income countries should be concerned about having sufficient qualified personnel (such as nurses and physicians) and other resources (such as personal protective equipment), which has been one of the main problems worldwide during the COVID-19 pandemic.

The main limitation of this study is the use of a nationwide administrative database that was not designed for clinical research. However, it is useful to present the general overview of mechanically ventilated COVID-19 patients in Mexico. Additionally, we excluded patients

*Correspondence: snamendys@gmail.com
[1] Division of Pulmonary, Anesthesia and Critical Care Medicine, Instituto Nacional de Ciencias Médicas y Nutrición Salvador Zubirán, 14000 Mexico City, Mexico
Full author information is available at the end of the article

Springer

Table 1 Characteristics of mechanically ventilated COVID-19 patients, according to in-hospital death

Characteristics	Total population ($n=12,018$)	Survivors ($n=3157$)	Non-survivors ($n=8861$)	p value*
Age, years, median (interquartile range)	60 (50–69)	56 (46–66)	61 (51–70)	< 0.001
18–34	581 (4.8)	270 (8.5)	311 (3.5)	< 0.001
35–54	3740 (31.1)	1188 (37.6)	2551 (28.7)	
55–64	3313 (27.6)	823 (26.1)	2490 (28.1)	
≥ 65	4384 (36.5)	876 (27.7)	3508 (39.6)	
Female, *n* (%)	4047 (33.7)	1086 (34.4)	2961 (33.4)	0.315
Male, *n* (%)	7971 (66.3)	2071 (65.6)	5900 (66.6)	
Ability to speak a Mexican indigenous language, *n* (%)	221 (1.8)	41 (1.3)	180 (2)	0.009
Medical treatment in the public healthcare system, *n* (%)	11,468 (95.4)	2877 (91.1)	8591 (96.9)	< 0.001
Medical treatment in the private healthcare system, *n* (%)	550 (4.6)	280 (8.8)	270 (3)	
Time from illness onset to hospital admission > 6 days, *n* (%)	3693 (30.7)	1063 (33.7)	2630 (29.7)	< 0.001
Invasive mechanical ventilation outside intensive care unit, *n* (%)	6928 (57.7)	1714 (54.3)	5214 (58.8)	< 0.001
Invasive mechanical ventilation in the intensive care unit, *n* (%)	5090 (42.3)	1443 (45.7)	3647 (41.1)	
Comorbidities, *n* (%)				
Hypertension	4802 (40)	1109 (35.1)	3693 (41.7)	< 0.001
Diabetes	4349 (36.2)	1019 (32.3)	3330 (37.6)	< 0.001
Obesity	3388 (28.2)	895 (28.3)	2493 (28.1)	0.818
Chronic kidney disease	603 (5)	137 (4.4)	466 (5.3)	0.042
Cardiovascular disease	590 (4.9)	141 (4.5)	449 (5)	0.180
Chronic obstructive lung disease	463 (3.9)	85 (2.6)	378 (4.3)	< 0.001
Immunosuppression	281 (2.3)	62 (2)	219 (2.5)	0.105
Asthma	237 (2)	55 (1.7)	182 (2)	0.279
No comorbidities**	3712 (30.9)	1116 (35.3)	2596 (29.3)	< 0.001
≥ 1 comorbidity	8306 (69.1)	2041 (64.6)	6265 (70.7)	

*Chi-square (categorical variables) or Mann–Whitney (continuous variables) tests ($\alpha = 0.05$)

**No comorbidities: patients had none of the listed comorbidities

who died outside of hospitals or who died before intubation.

Electronic supplementary material
The online version of this article (https://doi.org/10.1007/s00134-020-06256-3) contains supplementary material, which is available to authorized users.

Author details
[1] Division of Pulmonary, Anesthesia and Critical Care Medicine, Instituto Nacional de Ciencias Médicas y Nutrición Salvador Zubirán, 14000 Mexico City, Mexico. [2] Department of Critical Care Medicine, Instituto Nacional de Cancerología, Mexico City, Mexico. [3] Department of Critical Care Medicine, Hospital Médica Sur, Mexico City, Mexico.

Acknowledgements
This report is dedicated to all patients and health care workers who died due to COVID-19 in Mexico and around the world.

Author contributions
ÑS had full access to all of the data in the report and take responsibility for the integrity of the data and the accuracy of the data analysis. Concept and design: ÑS. Acquisition, analysis, or interpretation of data: All authors. Drafting of the manuscript: ÑS. Critical revision of the manuscript for important intellectual content: All authors. Statistical analysis: ÑS. Administrative, technical, or material support: ÑS. Supervision: ÑS.

Compliance with ethical standards

Conflicts of interest
The authors declared no conflict of interest.

Publisher's Note

Accepted: 19 September 2020
Published online: 30 September 2020

References

1. World Health Organization (2020) Coronavirus disease 2019 (COVID-19): situation report, 206. https://www.who.int/docs/default-source/coronaviruse/situation-reports/20200813-covid-19-sitrep-206.pdf?sfvrsn=bf38f66b_6. Accessed 15 Sept 2020
2. Datos Abiertos - Dirección General de Epidemiología, Secretaría de Salud, Gobierno de México. http://datosabiertos.salud.gob.mx/gobmx/salud

/datos_abiertos/historicos/08/datos_abiertos_covid19_13.08.2020.zip. Accessed 15 Sept 2020
3. ICNARC report on COVID-19 in critical care, 17 April 2020. https://www.icnarc.org/DataServices/Attachments/Download/c5a62b13-6486-ea11-9125-00505601089b. Accessed 15 Sept 2020
4. Karagiannidis C, Mostert C, Hentschker C, Voshaar T, Malzahn J, Schillinger G, Klauber J, Janssens U, Marx G, Weber-Carstens S, Kluge S, Pfeifer M, Grabenhenrich L, Welte T, Busse R (2020) Case characteristics, resource use, and outcomes of 10 021 patients with COVID-19 admitted to 920 German hospitals: an observational study. Lancet Respir Med 8(9):853–862. https://doi.org/10.1016/S2213-2600(20)30316-7