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Short Communication

Survival in adult inpatients with COVID-19

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ABSTRACT

Background: The mortality of the coronavirus disease 2019 (COVID-19) pandemic is high, and data regarding its prognosis are scarce. We aimed to assess the survival experience and determining factors in adult inpatients with laboratory-confirmed COVID-19.

Methods: We conducted a nationwide and retrospective cohort study. Data from 66,123 individuals were analyzed using the Kaplan-Meier method, and a multivariate Cox proportional hazard regression model was fitted.

Results: The 7-day survival was 72.2% and went to 47.6%, 35.0%, and 23.9% on days 15, 21, and 30 of hospital stay, respectively. In the multiple analysis, factors associated with an increased risk of dying were male gender, age, pneumonia at hospital admission, immunosuppression, and personal history of chronic non-communicable diseases. Reduced risk of a fatal outcome was observed among patients with asthma history.

Conclusions: To the best of our knowledge, this is the largest study analyzing the survival probability in a large subset of Latin-American adults with COVID-19, in whom the disease burden has been high. Our results contribute to achieving a better understanding of disease evolution.

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Background

Worldwide, the coronavirus disease 2019 (COVID-19) by severe acute respiratory syndrome coronavirus 2 (SARS-COV-2) pandemic represents unprecedented health and social crisis. The clinical spectrum of SARS-COV-2 infection is wide and includes asymptomatic contagion, mild upper and unspecific respiratory tract symptoms, and severe viral pneumonia.¹

The observed COVID-19 burden in Mexico has been high and, by the end of the first week of October 2020, more than 80 thousand deaths had been registered.² In accordance with normative standards that have been followed since the beginning of the pandemic, hospitalization criteria include the use of validated scales as Pneumonia Severity Index and confusion, urea level, respiratory rate, blood pressure, and age ≥ 65 .³

Published data regarding the clinical course of COVID-19 inpatients are scarce, particularly in Latin-American populations.

The evaluation of clinical outcomes in hospitalized patients with symptomatic SARS-COV-2 infection may help clinicians and epidemiologists better appreciate the disease evolution, and lead to a more efficient allocation of healthcare resources.⁴ This study aimed to assess the survival experience and associated factors in a large cohort of hospitalized adult inpatients with laboratory-confirmed COVID-19.

Methods

We conducted a nationwide and retrospective dynamic cohort study focusing on the survival of hospitalized adult patients with laboratory-confirmed (reverse transcription-polymerase chain reaction in nasopharyngeal and deep nasal swabs) COVID-19. Eligible subjects were identified from the nominal records of a normative and web-based system for the epidemiological surveillance of viral respiratory diseases, which belongs to the Mexican Institute of Social Security (IMSS, the Spanish acronym). A broader description of study methods was previously published.⁵

Individuals aged 18 years or older at acute illness onset and with conclusive evidence of COVID-19 by SARS-COV-2 were potentially

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Table 1
Hazard ratios of dying in adult inpatients with laboratory-confirmed COVID-19^a, Mexico 2020.

Characteristic	HR (95% CI), <i>p</i>		
	Bivariate analysis	Multiple analysis	
Gender			
Female	1.00	1.00	
Male	1.11 (1.08–1.13)	1.16 (1.13–1.18)	<0.001
Age group (years)			
20 - 29	1.00	1.00	
30 - 44	1.64 (1.47–1.83)	1.60 (1.44–1.79)	<0.001
45 - 59	2.52 (2.27–2.80)	2.37 (2.13–2.63)	<0.001
60+	3.92 (3.54–4.34)	3.55 (3.20–3.94)	<0.001
Clinically diagnosed pneumonia at hospital admission			
No	1.00	1.00	
Yes	1.48 (1.45–1.51)	1.41 (1.38–1.44)	<0.001
Personal history of:			
Tobacco use			
No	1.00	1.00	
Yes	1.08 (1.04–1.12)	0.97 (0.93–1.01)	0.115
Obesity (BMI 30 or above)			
No	1.00	1.00	
Yes	1.01 (0.99–1.04)	1.08 (1.05–1.11)	<0.001
Asthma			
No	1.00	1.00	
Yes	0.86 (0.80–0.93)	0.92 (0.85–0.99)	0.037
Chronic pulmonary obstructive disease			
No	1.00	1.00	
Yes	1.41 (1.34–1.48)	1.12 (1.07–1.18)	<0.001
Type 2 diabetes mellitus			
No	1.00	1.00	
Yes	1.30 (1.27–1.33)	1.09 (1.07–1.12)	<0.001
Arterial hypertension			
No	1.00	1.00	
Yes	1.36 (1.33–1.39)	1.08 (1.05–1.11)	<0.001
Immunosuppression ^b			
No	1.00	1.00	
Yes	1.13 (1.06–1.21)	1.08 (1.01–1.16)	0.021
Chronic kidney disease			
No	1.00	1.00	
Yes	1.46 (1.41–1.52)	1.36 (1.31–1.42)	<0.001

HR, hazard ratio; CI, confidence interval; BMI, body mass index; COVID-19, coronavirus disease 2019.

Notes: 1 Cox proportional hazard regression models were used to compute HR and 95% CI; 2) HR and 95% CI from multiple analysis were adjusted by variables listed in the table.

^a Self-reported household contact with a laboratory-confirmed case of COVID-19 within 14 days before symptoms onset.

^b Included any cause of immunosuppression except for type 2 diabetes mellitus or chronic kidney disease.

eligible. Subjects with hospital admission date later than August 15, 2020, were excluded, as well as those with missing clinical or epidemiological data of interest.

Clinical and epidemiological data of interest were collected from the audited database, which primary data sources are medical files and death certificates if applicable. We analyzed the survival time of hospitalized adult patients with COVID-19 measured as the time elapsed from the date of hospital entry (starting event) to the date of in-hospital death (final event). The censored variable was defined as the patients who did not present the event (did not die) during the follow-up period, and the date of hospital discharge was used to compute the time at risk. Factors associated with the risk of in-hospital death were evaluated through hazard ratios (HRs) and 95% confidence intervals (CIs), and a multivariate Cox proportional hazard regression model was fitted. The Local Committee in Health Research (601) of the IMSS provided approval (R-2020-601-015).

Results

Data from 66,123 participants (admitted to the hospital in a period of 164 days from March 4, 2020, to August 15, 2020) were analyzed for a total follow-up of 734,503 person-days. The overall COVID-19 in-hospital lethality rate ($n = 32,039$) was 43.6 per 1000

person-days. The median in-hospital stay was 7 (interquartile range, IQR, 3–12) and 9 days (6–14) in cases with the fatal and non-fatal outcomes, respectively ($P < 0.001$).

Most of the participants were men (60.7%) and those who died were older than recovered patients (62.7 ± 13 – 5 vs. 53.1 ± 14.5 , $P < 0.001$). Other clinical and epidemiological characteristics of interest are presented in [Supplementary Table 1](#).

The Kaplan-Meier curve is presented in [Supplementary Fig. 1](#). The survival probabilities (and 95% CI) of COVID-19 adult inpatients at different days from hospital admission were as following: 1, 95.5% (95.3%–95.7%); 3, 86.9% (86.6%–87.2%); 7, 72.2% (71.9%–72.6%); 15, 47.6% (47.1%–48.1%); 21, 35.0% (34.4%–35.5%); and 30, 23.9% (23.3%–24.5%).

In the multiple model ([Table 1](#)), a personal history of asthma (HR = 0.92, 95% CI: 0.85–0.99) showed a protective effect on dying. All other evaluated exposures (namely: male gender, increasing age, clinical pneumonia at hospital entry, and personal history of obesity, immunosuppression, and other chronic non-communicable diseases [type 2 diabetes mellitus, arterial hypertension, and renal disease]) were associated with an increased risk for a fatal outcome. The highest risk increase (HR = 1.41, 95% CI: 1.38–1.4) on dying was documented among patients with clinically diagnosed pneumonia at hospital admission.

Discussion

The results of this study describe the survival experience of hospitalized adults with COVID-19, and factors associated with disease outcomes were characterized. To the best of our knowledge, this is the largest study evaluating illness outcomes in a large subset of Latin-American COVID-19 inpatients.

The related burden of SARS-COV-2 in Mexico has been high and obesity and chronic non-communicable diseases (mainly type 2 diabetes mellitus), both of them showing epidemic characteristics in Mexican adults, may play a role in the observed scenario. The prevalence of type 2 diabetes mellitus and arterial hypertension in our study sample was significantly higher than national means (diabetes, 33.0% vs. 10.3%, $P < 0.001$; hypertension, 40.4% vs. 18.4%, $P < 0.001$).⁶ These findings were secondary to the inclusion of cases requiring hospitalization because the personal history of chronic illness has been associated with a greater risk of severe COVID-19 manifestations and hospital entry.⁷

Our survival estimates are a bit higher than those recently documented in Brazil, where the 15-day rate was around 40% (vs. 47.6% from our analysis).⁸ According to the authors from the cited Brazilian study,⁸ the lack of standardized protocols for clinical management of COVID-19 inpatients may be determining, at least partially, the observed scenario. The computed 14-day survival rate in a study that took place in the city of New York (U.S.), and where 2773 inpatients were analyzed, was around 50%,⁹ and it is 5% higher than ours. Demographic characteristics and country-specific control policies may have contributed, at least partially, to these observed differences.¹⁰

The inclusion of only laboratory-positive cases, together with the large sample size and national representativeness, are major strengths of this study. However, potential limitations must be cited. First, we were unable to assess a gradient between body mass and survival functions because anthropometric registers are not collected by the audited epidemiological surveillance system. Instead, obesity data are collected as a dichotomous variable. And second, no biomarkers data were available and which may have improved the accuracy of built models.

Conclusions

The COVID-19 pandemic-related mortality in Latin-America has been high. The survival experience of hospitalized adults in Mexico was documented in this nationwide study, and factors determining the illness outcome were assessed. Because obesity and other related chronic non-communicable diseases such type 2 diabetes mellitus and arterial hypertension were associated with a poorer prognosis, our results highlight the major relevance of public health policies and interventions focusing on their prevention in the analyzed population.

Author statements

Ethical approval

None sought.

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Competing interests

None to declare.

Data availability statement

The data that support the findings of this study are available on request to the corresponding author.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.puhe.2020.10.029>.

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