Risk factors on admission and condition at discharge of 529 consecutive COVID-19 patients at a tertiary care center in Santiago, Chile

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Research Article

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Abstract

**Background:** The first case of COVID-19 was reported in Chile on March 3, 2020. Public and private hospitals were managed in a centralized manner. On May 30, Chile had 99,668 cases, 1054 deaths, 1383 ICU patients, 1174 patients on invasive mechanical ventilation (IMV), and 51 patients on non-invasive ventilation (NIMV).

**Research question:** What are the variables associated with condition at discharge?

**Method:** We performed a retrospective cohort study of 529 patients with a positive RT-PCR for SARS CoV-2 who were consecutively discharged between March 14 and June 4, 2020, at Clínica Dávila, Santiago. Patients were analyzed according to laboratory variables on admission, Quality-Adjusted Life Year (QALY) score, health insurance, and type of respiratory support. Condition at discharge was survivor, non-survivor, or transfer to another center. Differences were evaluated by Chi-square test, Student’s t test, or Mann–Whitney U test. Logistic regression analysis was performed to identify variables that were predictive of condition at discharge.

**Results:** Median (interquartile range, IQR) age was 49 (37–62) years, and the median (IQR) stay in the hospital was 6 (3–10) days. A total of 352 patients (66.5%) had respiratory symptoms, 177 (33.4%) had other symptoms or diagnoses on admission, and 116 required ventilatory support; 448 (84.7%) were survivors, 54 (10.2%) were non-survivors, and 27 (5.1%) were transferred. The median ages of the survivors and non-survivors were 46 (36–59) and 75.5 (66–84), respectively.

Having state health insurance increased the risk of death by 2.8-fold (OR, 2.825; 95% CI: 1.383–5.772; P = 0.004). Multivariate analysis revealed the following predictive variables: age $\geq$ 60 years (OR, 15.3; 95% CI: 7.25–32.2; P = .001); PaO$_2$/FiO$_2$ on admission $\leq$ 200 vs $>$ 200 (OR, 5,205; CI 95%: 1,942–13,94); high-sensitivity troponin, $\geq$ 15 vs <15 ng /L (OR, 5,163; 95% CI: 1.95–13,64; P = .001); and QALY $\leq$ 15 vs $>$ 15 points (OR, 4,826–40,679; P=.001).

**Interpretation:** The variables analyzed and patient’s clinical evolution may allow assignment of ICU beds to patients with the greatest chance of survival, especially in countries or regions where this resource is limited.

Introduction

On March 3, 2020, the first case of COVID-19 was reported in Chile. Over the following days, a growing number of cases were reported in the central and southern zones of the country, reaching the Metropolitan Region in mid-March 2020. The Chilean Ministry of Health assumed centralized control of all beds in public and private hospitals. By May 30, 2020, in the country as a whole, 99668 patients were infected and 1054 had died. A total of 1383 patients were in intensive care units (ICUs); 1174 were on invasive mechanical ventilation (IMV) and 51 on non-invasive mechanical ventilation (NIMV). At the same time, the Chilean Society of Intensive Medicine reported that 253 patients were on IMV outside critically ill adult units. Clínica Dávila, Hospital San José, and Hospital Clínico de la Universidad de Chile are the main level III hospitals in the northern area of Santiago.

Before the pandemic Clínica Dávila had 647 beds, including beds for adult and pediatric cases of varying degrees of complexity.

By June 4, 2020, Clínica Dávila had 334 COVID-19 beds with an occupancy of 95.8%. The number of ICU beds for adult COVID-19 patients increased by 500%, from 12 to 62, including 15 ICU beds in surgical rooms with all patients on IMV. The number of intermediate care unit (IMCU) beds increased by 300%, from 24 to 72, with 68 hospitalized patients, of whom 30 were connected to NIMV, 16 were connected to high-flow nasal cannula (HFNC), and four were ventilated by tracheostomy (TQT) through adapted non-invasive ventilators.

Overall, 81% of COVID-19 infections are mild, 14% severe, and 5% require intensive care$^1$. The mortality rates published by China, Italy, and the United States range from 1.4% among hospitalized patients$^2$ to 61.5% among critically ill patients$^3$. 

**Objectives**
Primary objective: To analyze demographic, clinical, and laboratory characteristics at admission that may have prognostic value regarding the condition of patients at discharge.

Secondary objective: To analyze the type of ventilatory support used and condition at discharge.

**Methods**

**Patients and method**

This study was conducted in accordance with the Declaration of Helsinki⁴ and approved by the Ethical and Scientific Committee of Clínica Dávila.

**Patients and data collection**

All patients with positive laboratory tests for SARS CoV-2, hospitalized and discharged between March 14, 2020 and June 04, 2020, were included in this study. The patients were discharged in the following sequence: in March, six patients; in April, 17 patients; in May, 452 patients (85.4%); and in the first 4 days of June, 54 patients.

COVID-19 disease was diagnosed based on guidelines from the World Health Organization (WHO). Confirmed cases were patients with positive results from real-time polymerase chain reaction (RT-PCR) test for SARS CoV-2, performed on samples of the upper respiratory tract harvested by nasopharyngeal swab⁵. Positive patients were entered into the mandatory notification system, Epivigila (https://epivigila.org.cl)⁶, created by the Ministry of Health. The most frequent respiratory symptoms were dyspnea, odynophagia, cough, and chest pain. Other predominant symptoms were vomiting, diarrhea, abdominal pain, and myalgias.

Gender, age, health insurance, duration of symptoms before admission, and comorbidities (T2DM, HT, cancer, HIV, immunosuppression from other causes, heart failure, kidney failure, obesity, coronary heart disease, bronchial asthma, active smoking, and chronic obstructive pulmonary disease) were recorded. For all patients, the Quality-Adjusted Life Year (QALY) score was calculated. QALY is a generic measure of disease burden that is used to evaluate the impact of therapeutic measures on the quality of survival expected with or without an intervention. It considers the life expectancy of a country or region from which the patient's age number is subtracted; the resultant value is multiplied by 1 in the absence of comorbidities, or in the case of existing comorbidities, 0.1 is subtracted from factor 1 for each compensated comorbidity, 0.2 for each decompensated comorbidity (or in the case of a semi-dependent patient), and 0.3 if the patient was previously bedridden⁷. Also, duration of hospitalization and non-invasive and invasive ventilatory support (expressed in days) were recorded. The type of bed used by the patient before discharge or transfer to another center was also recorded.

**Sample collection, ethological agent, and laboratory tests**

Laboratory examinations on admission were taken in the emergency room, or within the first 3 hours of admission, including RT-PCR for SARS CoV-2, arterial blood sample for arterial gases, relationship between the arterial partial pressure of O₂ (expressed in mmHg) and the fraction of O₂ that the patient was breathing at the time the sample was obtained (PaO₂/FiO₂), ferritin, D Dimer, C-reactive protein (PCR), procalcitonin, platelet count, white blood cell count, viral panel by real-time PCR (identifying 17 viruses), bacterial panel by real-time PCR (identifying seven bacteria), urinary antigen for *Pneumococcus* and *Legionella*, blood cultures, and positive expectoration cultures.

**Methods of administration of oxygen and ventilatory support used**

Administration of O₂ was carried out as follows: 1. Through the nose at a flow rate of up to 4 L/min. 2. High-flow multi-vent mask with FiO₂ from 40% to 50%. 3. Non-rebreather mask that delivered an FiO₂ between 50% and 90%.

Administration of O₂ through a HFNC was performed using AIRVO 2 (Fisher & Paykel, New Zealand).
For NIMV, we used Philips Respironics V60, BiPAP Vision, Trilogy 100, and Trilogy 202 equipment. For IMV, we used Avea, Vela, Bellavista (VYAIRE Medical, INC), Engström Carestation (General Electric), MAQUET (Getinge group), Nellcor Puritan Bennett 840 (Medtronic), and GE Datex Ohmeda Aestiva 5 (General Electric) anesthesia machines. The duration of these two modalities of ventilatory support (NIMV and IMV) was measured in days.

Discharge conditions: survivor, non-survivor, or transfer to another institution.

**Statistical analysis**

A retrospective cohort study was performed on 529 patients with a positive RT-PCR for SARS CoV-2 consecutively discharged between March 14 and June 4, 2020 at Clínica Dávila, Santiago. Clinical information was obtained from the electronic medical record of Clínica Dávila and collected in a database designed to ensure that the identities of the patients was protected.

Categorical variables were described using absolute and relative frequencies, and quantitative variables were described using means and standard deviation for those with normal distributions and with median and interquartile range (Q1, Q3) for those without normal distributions. For the categorical variables, association with condition at discharge was evaluated using the Chi-square test, whereas for quantitative variable, association was evaluated using Student’s test (normal distribution) or Mann–Whitney U test (non-normal distributions). To assess risk factors for discharge status, we used univariate and multivariate logistic regression models. First, the variables were analyzed individually; those with a p-value less than 0.1 were incorporated into a stepwise model with "forward-selection", and variables with a Pearson correlation greater than 0.8 were excluded to avoid collinearity and choose variables with greater predictive capacity. Finally, univariate models were used with variables categorized according to clinical criteria, and variables with a p-value less than 0.1 were again incorporated into a stepwise model. Significance level (α) less than or equal to 0.05. All analyses were performed using STATA v14.2 IC software (StataCorp. LLC, USA).

**Results**

**General characteristics, duration of symptoms, and cause of admission**

In this cohort of 529 COVID-19 patients, the median age (Q1, Q3) was 49 (37–62) years: 353 patients (68.5%) were younger than 50 years, 68 (13%) were 70 years or older, 14 (2.6%) were minors, three were newborns, seven were infants, and four were children (aged 6, 7, 10, and 14 years). Women made up 45% of the cohort (238/529).

The median duration of symptoms before admission was 6 days (3–10); 171 patients (32.3%) were hypertensive and 98 (18.5%) were diabetics. The median QALY score was 29.7 (16.8–43.7). In terms of insurance status, 317 patients (59.9%) had state health insurance, 195 (36.9%) had private health insurance, and 17 patients (3.21%) had no health insurance. Only 86 patients (16.2%) were registered as obese (BMI> 29.9). Active smoking was confirmed in 4% of patients (Table 1).

Of the 529 patients, 352 (66.5%) reported respiratory symptoms in the emergency department and had a chest CT scan with a COVID-19 pattern; on the other hand, in the remaining 177 patients (33.4%), the grounds for hospitalization were non-respiratory symptoms. Of those, 84 patients (15.9%) had digestive symptoms (nausea, vomiting, diarrhea, or difficult-to-control abdominal pain) or intense myalgia and headache that had not responded to outpatient management. Ninety-three patients (17.6%) had other grounds for admission, but the presence of SARS CoV-2 was confirmed due to the obligatory testing of all patients who were hospitalized during that period. Thirty-five were pregnant adult women hospitalized for pregnancy complications or in labor. Only two puerperal patients presented respiratory symptoms and required IMV. Both had pulmonary compromise on chest CT, and neither died. Thirty-two patients were admitted for other non-infectious causes (acute coronary syndrome, deep vein embolism thrombus, and others), and 23 were admitted for other concomitant infections (acute cholecystitis, acute pyelonephritis, cholangitis, and others) (Table 1).

The median duration of symptoms before admission was 6 days (3–8), and the median duration of hospital stay was 6 days (3–10).

**Global lethality, according to age, QALY score, respiratory support, health insurance, and other conditions**
At discharge, 448 patients (84.7%) were survivors, with a median age of 46 (36–59) years; 54 were non-survivors (10.2%) with a median age of 75.5 (66–84) years (p = 0.001). Of the 54 non-survivors, 45 (83.3%) were 60 years or older; the lethality in this group was 29% (Table 2).

The median QALY score of the survivors was 33 (9.7–44.7) points, and in non-survivors, the median was 4.4 (-2.2–12.3) points (p = 0.001). The median duration of hospitalization was 6 (4–10) days for survivors and 6.5 (4–13) days for non-survivors (p = 0.337) (Table 2).

Of 529 patients, 177 did not receive oxygen or ventilatory support, 236 received oxygen at variable rates or HFNC, and 116 received ventilatory support with NIMV or IMV. None of the patients underwent extracorporeal membrane oxygenation (Table 3).

Of the 116 patients who received support ventilation, 67 were discharged alive (57.8%), 28 died in the hospital (24%), and 21 were transferred to another hospital (18%) (Tables 2 and 3).

In terms of health insurance status, 317 patients had state health insurance, and 42 of these individuals died in the hospital (15.4%); their mean age (p25, p75) was 53.2 (40–66) years. A total of 195 patients had private insurance, and 10 of these individuals (5.12%) died in the hospital (p = 0.001); their mean age was 45 (33–57) years (Table 4 and 2). Thus, having state health insurance increased the risk of death by 2.8-fold (OR, 2.825; 95% CI: 1.383–5.772; P = 0.004) (Table 5).

In our cohort, obesity was not identified as a poor prognostic factor: 15.8% of those who survived and 16.7% of those who died were obese (p = 0.437) (Table 2).

Univariate and multivariate logistic analysis of demographics, comorbidities, and laboratory variables.

In the univariate analysis, the clinical variables on admission that differed significantly between survivors and non-survivors were age, hypertension, and diabetes. Laboratory variables that differed significantly were procalcitonin, ferritin, PaO$_2$/FiO$_2$ at admission, leukocytes, double dimer, and creatinine (Table 5).

Categorized variables results

We considered the results of published studies$^{2,3,8,9}$ and applied cut-off points for demographic and laboratory variables obtained on admission. We then analyzed its relationship with the condition at discharge. Univariate logistic analysis revealed that age (≥ 60 years), QALY score (≤ 15 vs. > 15 points), double dimer D (> 1 vs. ≤ 1 ug/ml), high-sensitivity troponin (≥ 15 vs. <15 ng/L), CRP (>8.2 vs. ≤ 8.2 mg/dl), procalcitonin (≥ 0.5 vs. < 0.5 ng/ml), and creatinine (> 1.4 vs. ≤ 1.4 mg%) were significantly associated with the risk of death at discharge (Table 6).

The multivariate logistic analysis revealed that QALY score (≤ 15 vs. > 15 points), PaO$_2$/FiO$_2$ on admission (≤ 200 vs. > 200), and high-sensitivity troponin (≥ 15 vs. <15 ng/L) were risk factors of death at discharge (Table 6).

Discussion

In a previous series of 393 consecutive cases examined in New York city$^{10}$, the median age was 62.2 years (48.6–73.7) and 40 patients died, corresponding to an overall lethality of 10.2%. In our series, the lethality was the same (10.2%), but our patients were younger with a median age of 49 years (37–62). In the previously described series, 130 patients needed IMV (33%), and the lethality of that group was 14.6% (19 patients). In our series, 84 patients (15.9%) needed IMV, of whom 46 (54.7%) survived, 18 died (21.4%), and 20 (23.8%) were transferred to other centers (Table 2).

The strategy used in the New York group involved early IMV essentially without the use of HFNC or NIMV. In our series, patients who had no indication for intubation upon arrival at the emergency room received O$_2$ at increasing flow rates, with or without HFNC and NIMV. Lack of response led to IMV (Table 2).

In an analysis of a consecutive series of 78 patients, 11 patients (14.1%) presented with progression of respiratory failure and 62 improved or stabilized. Those who deteriorated were older, tended to be smokers, and had more comorbidities$^{11}$. 


In our cohort, patients with state health insurance were 2.8 times more likely to die than patients with private health insurance. In part, this may have been because the mean age of patients with state insurance was 53.2 ± 17.8 years, whereas that of patients with private insurance was 45 ± 17.3 years (p = 0.001). In the group with state health insurance, 38% were ≥ 60 years old. Meanwhile, among the patients with private health insurance, only 19.4% of patients were ≥ 60 years old (Tables 5 and 6).

In patients with severe ARDS admitted to the ICU, PaO$_2$/FiO$_2$ has prognostic value. In our clinical practice during the pandemic, we used PaO$_2$/FiO$_2$ ≤ 200 on admission to identify patients who needed to enter the intermediate care unit for HFNC or NIMV. On the other hand, patients with PaO$_2$/FiO$_2$ > 200 were hospitalized in the general ward with supplementary oxygen. We retrospectively analyzed our series and found that this cut-off point had prognostic value.

In our patients, we categorized patients as QALY ≤ 15 or QALY > 15 points. In the multivariate analysis, this cut-off point showed a strong statistical significance for risk of death at discharge. Regardless of their clinical condition, we calculated the QALY score for all patients who were enrolled in our study. The purpose of this calculation was to identify patients who would benefit from an ICU bed in the clinical scenario of severe ARDS. This was important due to the limited number of these units and the need to transfer to another center with free ICU beds. Transfer was under the jurisdiction of the Centralized Bed Management Unit (UGCC) of the Chilean Ministry of Health. In our cohort, 27 patients were transferred to other centers with an available ICU bed.

One review of support modalities in acute respiratory failure in patients with COVID-19 recommend the use of HFNC in cases with mild respiratory insufficiency (PaO$_2$/FiO$_2$ between 200 and 300). In cases with moderate respiratory insufficiency (Pa/FiO$_2$ between 100 and 200), NIMV alone could be useful. The authors of that review also suggested that rotation between the two modes (HFNC and NIMV) may be a beneficial strategy when PaO$_2$/FiO$_2$ increases and respiratory rate or volume/minute improves. However, the timely availability of IMV when this mixture fails depends on the center, as the prolonged use of NIMV without an evident clinical response and persistence of increased respiratory work can generate more damage.

Conclusions

Our analysis of 529 consecutive patients included patients who were younger than the cases reported in North America and Europe. Lethality was 10.2%. A third of patients who were hospitalized had no respiratory symptoms. The remaining two-thirds had varying degrees of respiratory failure. Of those, 116 (21.9%) required ventilatory support.

Patients over age of 60 or with QALY scores <15 were at higher risk of dying. From the admission laboratory, patients with PaO$_2$/FiO2 < 200, high-sensitivity troponin ≥ 15 ng/ml, or creatinine > 1.4 mg% also had a higher risk of dying.

Due to the reduced availability of ICU beds in the pandemic context, it was important to determine variables upon admission that allow clinicians to assign those beds to patients with the greatest chance of survival, especially in countries or regions where this resource is limited.

The differences in the prognosis that we observed between patients with state health insurance and private health insurance were related to the older age and higher burden of disease, expressed by the QALY score, in the former group.

Research limitations

We did not register the severity of the lung involvement in the lung CT SCAN of patients and follow-up laboratory variables. The only variable that we registered post-admission was the determination of PaO$_2$/FiO$_2$ before connection to NIMV or IMV. We consider that the tobacco habit was under registered. Information about obesity was absent in some patients.

Declarations

Conflicts of interest

The authors have no conflicts of interest related to this study.

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Tables

Table 1. Characteristics of COVID-19 patients (n= 529)
| Variables                        | Absolute freq/ Relative freq/ |
|---------------------------------|--------------------------------|
|                                 | Average/ median Standard dev/ IQR |
| Sex                             | Female 238 45.0  Male 291 55.0 |
| Age range                       | <18 14 2.6  19–39 151 28.5  40–49 102 19.3  50–59 100 18.9  60–69 94 17.8  ≥70 68 12.9 |
| BMI*                            | <30 244 46.1  ≥29.9 86 16.3 |
| Smoking                         | No 506 95.7  Yes 21 4.0 |
| Comorbidities                   | Arterial hypertension 171 32.3  Diabetes mellitus 98 18.5 |
| Health insurance                | State health insurance 317 59.9  Private health insurance 195 36.9  Without health insurance 17 3.2 |
| Motive for admission            | Symptoms respiratory due to COVID-19 352 66.5  Digestive symptoms, myalgias, and headache due to COVID-19 84 15.9  Gyneco–obstetric cause 35 6.6  Other infectious processes 23 4.3  Other non-infectious processes 32 6.0  Newborn 3 0.6 |
| Condition                       | Age (years) 49 (37–62)  QALY** score (points) 27.7 (16.8–43.7)  Days with symptoms 6 (3–8)  Days in hospital 6.0 (3–10) |
| Laboratory                      | PaO₂/FiO₂ at admission 304 (231–355)  PaO₂/FiO₂ pre-mechanical ventilation 157.7 53.0  Ferritin (ng/ml) 785 (362–1524)  Double dimer (µg/ml) 0.3 (0.2–0.6)  High-sensitivity troponin (ng/L) 6.9 (4.4–12.5)  C-reactive protein (mg/dl) 7.1 (2.9–14.4)  Procalcitonin (ng/ml) 0.1 (0.1–0.3)  Platelets, × 10⁹/L 230 (180–295)  Leukocytes, × 10⁹/L 7.4 (5.5–10.5)  Creatinine (mg%) 0.8 (0.7–1.0) |
* Body mass index, expressed in kg/m$^2$.
† Quality-adjusted life year (QALY) score is a generic measure of disease burden.

Table 2. Demographic characteristics, health insurance, laboratory, motive of admission, and support type given, according to discharge condition
| CATEGORY/ VARIABLE | Survivors | | | Non-survivors | | | | Transferred | | | p-value |
|-------------------|-----------|---|---|----------------|---|---|---|----------------|---|---|---|
| | Absolute | Relative | Absolute | Relative | Absolute | Relative | Absolute | Relative |
| | freq | Average | freq | Standard | freq | Average | freq | Standard |
| | | Median | dev | | | Median | dev | |
| N | 448 | 84.7 | 54 | 10.2 | 27 | 5.1 | | |
| Median age (IQR), years | 46 | (36-59) | 75.5 | (66-84) | 56 | (39-61) | <.001 |
| QALY† score (points) | 33 | (19.7-44.7) | 4.4 | (-2.2-12.3) | 23.7 | (18.2-37.5) | <.001 |
| Days with symptoms | 6 | (3-8) | 5.0 | (3-7) | 7.0 | (5-10) | .80 |
| Days in hospital | 6 | (4-10) | 6.5 | (4-13) | 2.0 | (1-4) | .33 |
| Laboratory | | | | | | | | |
| PaO₂/FiO₂ at admission | 316 | (261-360) | 167 | (80-268) | 212 | (130-291) | <.001 |
| PaO₂/FiO₂ pre-mechanical ventilation | 148.0 | 47.0 | 127.7 | 62.7 | 103.2 | 46.2 | .09 |
| Ferritin (ng/ml) | 764 | (337-1445) | 695 | (399-2176) | 1060 | (546-1875) | .46 |
| Double dimer (µg/ml) | 0.3 | (0.2-0.5) | 0.8 | (0.4-2.0) | 0.3 | (0.2-0.6) | <.001 |
| High-sensitivity troponin (ng/ml) | 5.8 | (4.1-9.3) | 22.8 | (15.1-44.9) | 7.3 | (5.8-12.5) | <.001 |
| C-reactive protein (mg/dl) | 6.3 | (2.3-13) | 13.9 | (6.7-26.0) | 14.2 | (6.1-24.6) | <.001 |
| Procalcitonin (ng/ml) | 0.1 | (0.1-0.2) | 1.0 | (0.3-1.8) | 0.2 | (0.1-0.5) | <.001 |
| Platelets, × 10⁹/L | 230.0 | (183-293) | 229.0 | (152-335) | 229.0 | (162-278) | .675 |
| Leukocytes, × 10⁹/L | 7.2 | (5.4-9.8) | 9.8 | (6.5-14.7) | 7.7 | (6.1-11) | <.001 |
| Creatinine (mg%) | 0.8 | (0.7-1.0) | 1.16 | (0.8-1.8) | 0.8 | (0.7-1.1) | <.001 |
| Sex | | | | | | | | |
| Female | 205 | 45.8 | 24 | 44.4 | 9 | 33.3 | .45 |
| Male | 243 | 54.2 | 30 | 55.6 | 18 | 66.7 | |
| Age range | | | | | | | | |
| <18 | 14 | 3.1 | 0 | 0.0 | 0 | 0.0 | <.001 |
| 19-39 | 141 | 31.5 | 3 | 5.6 | 7 | 25.9 | |
| 40-49 | 97 | 21.7 | 2 | 3.7 | 3 | 11.1 | |
| 50-59 | 87 | 19.4 | 4 | 7.4 | 9 | 33.3 | |
| 60-69 | 81 | 18.1 | 8 | 14.8 | 5 | 18.5 | |
| ≥ 70 | 28 | 6.3 | 37 | 68.5 | 3 | 11.1 | |
| BMI* | | | | | | | | |
| <30 | 214 | 47.8 | 20 | 37.0 | 10 | 37.0 | .43 |
| >29.9 | 71 | 15.8 | 9 | 16.7 | 6 | 22.2 | |
| Smoking | | | | | | | | |
| No | 430 | 96.0 | 53 | 98.1 | 23 | 85.2 | .011 |
| Yes | 16 | 3.6 | 1 | 1.9 | 4 | 14.8 | |
| Health insurance | | | | | | | | |
| State health insurance | 255 | 56.9 | 42 | 77.8 | 20 | 74.1 | .001 |
| Private health insurance | 183 | 40.8 | 10 | 18.5 | 2 | 7.4 | |
| Without health insurance | 10 | 2.2 | 2 | 3.7 | 5 | 18.5 | |
| Motive of admission | Respiratory and non-respiratory symptoms due to COVID-19 | 360 | 80.4 | 49 | 90.7 | 27 | 100.0 | .12 |
|---------------------|--------------------------------------------------------|-----|-------|---|------|---|-------|-----|
|                     | Gyneco-obstetric cause                                 | 35  | 7.8  | 0  | 0.0  | 0  | 0.0  |     |
|                     | Other infectious processes                             | 22  | 4.9  | 1  | 1.9  | 0  | 0.0  |     |
|                     | Other non-infectious processes                         | 28  | 6.3  | 4  | 7.4  | 0  | 0.0  |     |
|                     | Newborn                                                | 3   | 0.7  | 0  | 0.0  | 0  | 0.0  |     |
| Type of support and prognosis | Only environmental $O_2$                             | 174 | 38.8 | 1  | 1.9  | 2  | 7.4  | .001|
|                     | Only supplementary $O_2$                               | 179 | 40.0 | 20 | 37.0 | 3  | 11.1 |     |
|                     | Only HFNC‡                                            | 28  | 6.3  | 5  | 9.3  | 1  | 3.7  |     |
|                     | HFNC + NIMV§                                          | 11  | 2.5  | 2  | 3.7  | 0  | 0.0  |     |
|                     | Only NIM                                             | 10  | 2.2  | 8  | 14.8 | 1  | 3.7  |     |
|                     | NIMV + IMV‖                                          | 2   | 0.4  | 6  | 11.1 | 6  | 22.2 |     |
|                     | IVM                                                   | 44  | 9.8  | 12 | 22.2 | 14 | 51.9 |     |
| Last bed            | BASIC                                                 | 441 | 98.4 | 25 | 46.3 | 7  | 25.9 | .001|
|                     | MEDIUM                                                | 4   | 0.9  | 6  | 11.1 | 2  | 7.4  |     |
|                     | ICU                                                   | 0   | 0.0  | 16 | 29.6 | 16 | 59.3 |     |
|                     | IMCU¶                                                 | 3   | 0.7  | 7  | 13.0 | 2  | 7.4  |     |

* Body mass index, expressed in kg / m².
† Quality-adjusted life year (QALY) score is a generic measure of disease burden.
‡ High-flow nasal cannula.
§ Non-invasive mechanical ventilation.
‖ Invasive mechanical ventilation.
¶ Intermediate care unit.

Table 3. Type of support delivered, age, $\text{PaO}_2/\text{FiO}_2$ at admission, prognosis at discharge, and lethality in patients with COVID-19.
| Support                  | Total | Age (years) | Standard dev | PaO$_2$/FiO$_2$ at admission | Standard dev | Survivors | Non-survivors | Transferred | Lethality (%) |
|-------------------------|-------|-------------|--------------|-----------------------------|--------------|-----------|---------------|-------------|---------------|
| Environmental air       | 177   | 40.7        | 17.5         | 363.3                       | 50.4         | 174       | 1             | 2           | 0.6           |
| O$_2$* to HFNC†         | 236   | 56.5        | 20.5         | 378                         | 9.9          | 207       | 25            | 4           | 10.6          |
| NIMV‡ and/or IMV§ TOTAL | 116   | 55.8        | 15.08        | 229.5                       | 91           | 67        | 28            | 21          | 24.1          |
| TOTAL                   | 529   | 49.8        | 18.0         | 287.6                       | 93.1         | 448       | 54            | 27          | 10.2          |

*O$_2$ for oxygen low flow nasal cannula, multi-vent mask and non-rebreathed mask with reservoir.
†High-flow nasal cannula.
‡Non-invasive mechanical ventilation.
§Invasive mechanical ventilation.

Table 4. Description of demographic variables, QALY score, laboratory results, time of symptoms, PaO$_2$/FiO$_2$ at admission, and pre-mechanical ventilation, according to health insurance.
| Health            | Variable                                | N   | mean | SD  | min | p25 | p50 | p75 | max |
|-------------------|-----------------------------------------|-----|------|-----|-----|-----|-----|-----|-----|
| **State health insurance** | Age (years)                             | 317 | 53.2 | 17.8 | 0   | 40  | 54  | 66  | 97  |
|                   | QALY* score (points)                    | 317 | 26.7 | 17.8 | -13.04 | 13.23 | 25.7 | 39.7 | 80.7 |
|                   | PaO$_2$/FiO$_2$ at admission            | 238 | 275.4 | 101.4 | 47  | 222 | 300 | 350 | 476 |
|                   | PaO$_2$/FiO$_2$ pre-mechanical ventilation | 74  | 125.7 | 51.9 | 47  | 82.2 | 129 | 160 | 256 |
|                   | Ferritin (ng/ml)                        | 227 | 1153.2 | 1472.9 | 11  | 383 | 785 | 1515 | 14146 |
|                   | Double dimer (µg/ml)                    | 254 | 0.8  | 1.4  | 0.13 | 0.19 | 0.335 | 0.7 | 8.36 |
|                   | High-sensitivity troponin (ng/L)        | 219 | 16.6 | 64.2 | 3   | 4.6 | 7.3 | 14.1 | 933.5 |
|                   | C-reactive protein (mg/dl)              | 292 | 11.8 | 11.5 | 0.03 | 3.66 | 8.405 | 15.735 | 60.22 |
|                   | Procalcitonin (ng/ml)                   | 51  | 1.7  | 8.6  | 0.05 | 0.05 | 0.06 | 0.45 | 60.97 |
|                   | Platelets, × 10$^9$/L                   | 295 | 255.5 | 111.3 | 21.1 | 185 | 239 | 308 | 824 |
|                   | Leukocytes, × 10$^9$/L                  | 295 | 9.7  | 7.7  | 2.7  | 5.7 | 7.9 | 11.2 | 65  |
|                   | Creatinine (mg%)                        | 273 | 1.0  | 0.8  | 0.15 | 0.68 | 0.8 | 1.01 | 9.79 |
|                   | Days with symptoms                      | 317 | 6.1  | 4.5  | 0   | 3   | 6   | 8   | 30  |
|                   | Days in hospital                        | 317 | 7.5  | 6.4  | 1   | 3   | 5   | 10  | 42  |
| **Private health insurance** | Age (years)                             | 195 | 45.0 | 17.3 | 0   | 33  | 45  | 57  | 93  |
|                   | QALY score (points)                     | 195 | 34.4 | 17.4 | -8.61 | 22.7 | 33.93 | 46.7 | 80.7 |
|                   | PaO$_2$/FiO$_2$ at admission            | 124 | 309.4 | 73.0 | 69.2 | 261.25 | 315 | 365.85 | 471 |
|                   | PaO$_2$/FiO$_2$ pre-mechanical ventilation | 34  | 154.0 | 47.0  | 73  | 115 | 152 | 187 | 283 |
|                   | Ferritin (ng/ml)                        | 121 | 1004.6 | 847.9  | 7.43 | 255 | 756 | 1624 | 3761 |
|                   | Double dimer (µg/ml)                    | 143 | 0.9  | 3.0  | 0.15 | 0.16 | 0.3 | 0.5 | 33.2 |
|                   | High-sensitivity troponin (ng/L)        | 125 | 11.8 | 16.7 | 3   | 4.1 | 6   | 9.7 | 128.6 |
|                   | C-reactive protein (mg/dl)              | 174 | 8.1  | 8.5  | 0.03 | 1.47 | 5.42 | 12.81 | 53.73 |
|                   | Procalcitonin (ng/ml)                   | 32  | 1.1  | 3.9  | 0.05 | 0.05 | 0.085 | 0.185 | 21  |
|                   | Platelets, × 10$^9$/L                   | 174 | 235.7 | 94.7  | 60  | 178 | 223.5 | 271 | 648 |
|                   | Leukocytes, × 10$^9$/L                  | 175 | 7.5  | 3.8  | 5.7  | 5.3 | 6.9 | 8.9 | 29.4 |
|                   | Creatinine (mg%)                        | 151 | 1.0  | 0.8  | 0.37 | 0.7 | 0.88 | 1.03 | 6.45 |
|                   | Days with symptoms                      | 192 | 5.5  | 3.9  | 0   | 3   | 5   | 8   | 17  |
|                   | Days in hospital                        | 195 | 8.8  | 9.8  | 1   | 3   | 6   | 11  | 88  |
| **Without health insurance** | Age (years)                             | 17  | 43.2 | 16.4 | 18  | 33  | 38  | 56  | 86  |
|                   | QALY score (points)                     | 17  | 36.8 | 17.1 | -5.3 | 24.7 | 42.7 | 47.7 | 62.7 |
|                   | PaO$_2$/FiO$_2$ at admission            | 14  | 300.3 | 70.7  | 140 | 250 | 302 | 354 | 412 |
| Variable                              | N  | Mean   | Median | Q1   | Q3    | Max  | Min   |
|--------------------------------------|----|--------|--------|------|-------|------|-------|
| Age (years)                          | 529 | 49.8   | 18.0   | 0    | 37    | 62   | 97    |
| QALY score (points)                  | 529 | 29.9   | 18.0   | -    | 16.83 | 29.7 | 43.7  |
|                                      |     |        |        |      |       |      |       |
| PaO₂/FiO₂ at admission              | 376 | 287.6  | 93.1   | 47   | 231   | 304  | 355   |
| PaO₂/FiO₂ pre-mechanical ventilation | 116 | 135.7  | 53.0   | 47   | 92.5  | 135  | 170   |
| Ferritin (ng/ml)                     | 361 | 1098.2 | 1276.2 | 7.43 | 362   | 785  | 1524  |
| Double dimer (µg/ml)                 | 413 | 0.8    | 2.1    | 0.13 | 0.18  | 0.32 | 0.59  |
| High-sensitivity troponin (ng/L)     | 357 | 14.7   | 51.3   | 3    | 4.4   | 6.9  | 12.5  |
| C-reactive protein (mg/dl)           | 483 | 10.4   | 10.7   | 0.03 | 2.93  | 7.06 | 14.37 |
| Procalditonin (ng/ml)                | 89  | 1.8    | 7.6    | 0.05 | 0.05  | 0.08 | 0.29  |
| Platelets, × 10⁹/L                   | 486 | 248.4  | 105.9  | 21.1 | 180   | 230  | 295   |
| Leukocytes, × 10⁹/L                  | 487 | 8.9    | 6.5    | 5.7  | 5.5   | 7.4  | 10.5  |
| Creatinine (mg%)                     | 441 | 1.0    | 0.8    | 0.15 | 0.69  | 0.82 | 1.02  |
| Days with symptoms                   | 526 | 5.9    | 4.4    | 0    | 3     | 6    | 8     |
| Days in hospital                     | 529 | 7.9    | 7.8    | 1    | 3     | 6    | 10    |

* Quality-adjusted life year (QALY) score is a generic measure of disease burden.

**Table 5. Variables at admission with risk for death in COVID-19 patients, (N=529).**
| Variables                  | Univariate Analysis |           |          | Multivariate Analysis |           |          |
|---------------------------|---------------------|----------|----------|-----------------------|----------|----------|
|                           | OR                  | p-value  | 95% CI   | OR                    | p-value  | 95% CI   |
| Sex                       | Female              | 1        | -        | -                     | -        | -        |
|                           | Male                | 1.025    | 0.932    | 0.582                 | 1.806    |          |
| Conditions                | Age (years)         | 1.116    | 0.001    | 1.087                 | 1.146    | 0.922    |
|                           | QALY† score (points)| 0.888    | 0.001    | 0.863                 | 0.914    | 0.897    |
|                           | 95% CI              |          |          | 0.579                 | 1.4370   |          |
|                           | 0.734               |          |          | 1.806                 | 0.001    | 0.861    |
|                           | 0.934               |          |          |                      |          |          |
| Age range                 | 19–39               | 1        | -        | -                     | -        | -        |
|                           | 40–49               | 0.987    | 0.988    | 0.162                 | 6.011    |          |
|                           | 50–59               | 2.056    | 0.352    | 0.450                 | 9.387    |          |
|                           | 60–69               | 4.589    | 0.027    | 1.186                 | 17.760   |          |
|                           | 70 or more          | 58.882   | 0.001    | 17.063                | 203.192  |          |
| BMC*                      | <30                 | 1        | -        | -                     | -        | -        |
|                           | >29.9               | 1.309    | 0.524    | 0.572                 | 2.997    |          |
| Comorbidities             | Arterial hypertension| 8.370    | 0.001    | 4.345                 | 16.124   | 1.026    |
|                           | Diabetes mellitus   | 5.197    | 0.001    | 2.882                 | 9.374    | 1.828    |
|                           |                     |          |          | 0.394                 | 0.457    |          |
|                           |                     |          |          | 7.315                 |          |          |
| Health insurance          | Private health insurance | 1      | -        | -                     | -        | -        |
|                           | State health insurance| 2.825   | 0.004    | 1.383                 | 5.772    |          |
|                           | Without health insurance| 2.467  | 0.271    | 0.495                 | 12.301   |          |
| Laboratory                | PaO₂/FiO₂ at admission| 0.988   | 0.001    | 0.985                 | 0.992    | 0.992    |
|                           | PaO₂/FiO₂ pre-mechanical ventilation| 0.996 | 0.405 | 0.988 | 1.005 |          |
|                           | Ferritin (ng/ml)    | 1.000    | 0.017    | 1.000                 | 1.000    | 0.84     |
|                           | Double dimer (µg/ml)| 1.165    | 0.042    | 1.006                 | 1.349    | 1.227    |
|                           | High-sensitivity troponin (ng/ml)| 1.068 | 0.001 | 1.045 | 1.092 | 1.017 | 0.13 | 0.994 | 1.040 |          |
|                           | C-reactive protein (mg/dl)| 1.059 | 0.001 | 1.036 | 1.082 | 1.003 | 0.91 | 0.956 | 1.052 |          |
|                           | Procalcitonin (ng/ml)| 1.120 | 0.041 | 1.005 | 1.248 |          |          |
|                           | Platelets, × 10⁹/L  | 1.000    | 0.28     | 1.000                 | 1.000    |          |          |
|                           | Leukocytes, × 10⁹/L | 1.000    | 0.001    | 1.000                 | 1.000    | 0.016    |
|                           | Creatinine (mg%)    | 1.758    | 0.001    | 1.302                 | 2.373    |          |          |

*Body mass index, expressed in kg/m².
† Quality-adjusted life year (QALY) score is a generic measure of disease burden.

Table 6. Categorized variables at admission, and risk for death in COVID-19 patients, (N=529)
| Variables at admission                          | Univariate analysis |                      | Multivariate analysis |                      |
|------------------------------------------------|---------------------|----------------------|-----------------------|----------------------|
|                                                 | OR                  | p-value              | 95% CI                | OR                  | p-value | 95% CI |
| **Condition**                                  |                     |                      |                       |                     |         |        |
| Age (≥ 60 years vs. < 60 years)                 | 15.299              | 0.001                | 7.259 32.243          | -                   | -       | -      |
| QALY* score (≤ 15 vs. > 15 points)              | 24.628              | 0.001                | 11.857 51.155         | 14.011              | 0.001   | 4.826 40.679 |
| **Laboratory**                                 |                     |                      |                       |                     |         |        |
| PaO\textsubscript{2}/FiO\textsubscript{2} at admission (≤ 200 vs. > 200) | 11.605              | 0.001                | 5.872 22.938          | 5.205              | 0.001   | 1.942 13.949 |
| PaO\textsubscript{2}/FiO\textsubscript{2} pre-mechanical ventilation (≤ 100 vs. > 100) | 1.813               | 0.21                 | 0.716 4.595           | -                   | -       | -      |
| Ferritin (≥ 1000 vs. < 1000 ng/ml)              | 1.120               | 0.73                 | 0.578 2.168           | 1.728               | .34     | 0.552 5.406 |
| Double dimer (> 1 vs. ≤ 1 µg/ml)                | 4.648               | 0.001                | 2.396 9.014           | 1.728               | .34     | 0.552 5.406 |
| High-sensitivity troponin (≥ 15 vs. <15 ng/ml)  | 22.287              | 0.001                | 10.425 47.647         | 5.163              | 0.001   | 1.953 13.648 |
| C-reactive protein (> 8.2 vs. ≤ 8.2 mg/dl)      | 3.005               | 0.001                | 1.622 5.567           | -                   | -       | -      |
| Procalcitonin (≥ 0.5 vs. < 0.5 ng/ml)           | 12.545              | 0.001                | 2.730 57.648          | -                   | -       | -      |
| Platelets, [< 100 × 10\textsuperscript{9}/L vs. ≥ 100 × 10\textsuperscript{9}/L] | 0.286               | 0.071                | 0.073 1.116           | -                   | -       | -      |
| Leukocytes, [< 4.0 × 10\textsuperscript{9}/L vs. ≥ 4.0 × 10\textsuperscript{9}/L] | 1.978               | 0.35                 | 0.460 8.497           | 1.448               | 0.67    | 0.256 8.205 |
| Creatinine (> 1.4 vs. ≤ 1.4 mg%)                | 14.330              | 0.001                | 6.834 30.046          | -                   | -       | -      |

* Quality-adjusted life year (QALY) score is a generic measure of disease burden.