



Comparison of Survival and Clinical Profile of Adults with COVID-19 Hospitalized in Two Clinics in Medellín, Colombia

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Abstract

Purpose of Review This study compares the survival and clinical profile of hospitalized adults with COVID-19 in two clinics in the city of Medellín, Colombia, with a prospective study with 198 patients in clinic A and 201 in clinic B. Comparisons were made with chi-square and Mann–Whitney *U*, factors associated with survival were identified with a Cox regression.

Recent Findings The proportion of deaths was 7.1% in clinic A with a mean survival of 51.9 days (95% CI = 45–59); in clinic B 13.9% of patients died with mean survival of 37.8 days (95% CI = 32–43). The most prevalent comorbidities were hypertension (41.6%), diabetes (23.8%), obesity (15.0%), hypothyroidism (13.0%), dyslipidemia (11.0%), and chronic lung disease (10.8%) with similar proportions in both clinics. There were also differences by the clinic in the most prevalent complications: bacterial pneumonia (18.8%), acute renal failure (14.3%), and encephalopathy (9.5%). There were no differences in the days of hospitalization, mechanical ventilation (clinic A 23.7% and clinic B 29.4%) and admission to the ICU (25.3% in A and 32.3% in B).

Summary We evidence the heterogeneity of the survival and the clinical profile of the patients who are cared for by two institutions of the same city. These findings demonstrate the need to conduct unique studies for each institution, which poses a significant challenge for hospital epidemiology programs due to the impossibility of extrapolating evidence from other healthcare institutions and the need to implement personalized medicine programs given the clinical diversity of patients hospitalized for COVID-19.

Keywords COVID-19 · Provision of healthcare · Medical information · Epidemiology

Introduction

In late December 2019, a group of patients with severe pneumonia of unknown origin was reported in Wuhan, Hubei province, China [1••]. The disease would later be called coronavirus 2019 disease (COVID-19), which was caused by a new coronavirus identified as severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) [2, 3]. Like other highly pathogenic coronaviruses (SARS-CoV-1 and Middle East respiratory syndrome MERS), SARS-CoV-2 belongs to the β -genus within the *Coronaviridae* family, connected to certain species of bats. The rapid spread of SARS-CoV-2 worldwide prompted the World Health Organization (WHO) to declare the COVID-19 as a pandemic on March 11, 2020 [4]. China was the first epicenter of the pandemic, followed by Europe, the USA, and then South America. On March 6, 2020, Colombia reported its first case of COVID-19, a patient who came from Milan, Italy [5]. Since then, the number of

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cases in Colombia has increased steadily, and the country has become one of the most affected in Latin America, achieving its highest incidence peaks in July and December 2020 [6•].

The epidemiological and clinical presentation of COVID-19 has been well documented in several countries in Europe, Asia, and North America [7, 8••, 9•, 10], where similar results have been found concerning the main comorbidities, mortality, complications, sequelae, clinical and paraclinical manifestations. However, there is significant heterogeneity in the prevalences found in different groups, evidencing the impossibility of extrapolating these findings directly to the population living in other latitudes, since there are apparent genetic, nutritional, demographic, and sociocultural differences that make them diametrically diverse, which in turn results in differences in the clinical-epidemiological profile of each place.

Additionally, in Colombia, there are lack of knowledge or studies about the survival, clinical presentation, or the main clinical-epidemiological outcomes of COVID-19. The main publications correspond to Mexico, Brazil, Bolivia, and Chile [11–14]. For this reason, it is urgent to generate local data that can be compared with those that already exist in other geographical areas of the planet, especially in Colombia, where the documentation of this complex infectious-contagious phenomenon continues to be limited [15, 16].

Therefore, a detailed analysis of hospitalized cases could significantly improve knowledge about the disease, and consequently, provide specific information about COVID-19 in this region of the planet, which presents particularities such as its unique climate, social dynamics, population genetics, and political scene.

Based on the above, the objective of this research was to compare the survival and clinical profile of hospitalized adults with COVID-19 in two clinics in the city of Medellín, Colombia, 2020, taking into account that despite being located in the same city, both clinics treat socio-economically different populations.

Materials and Methods

Type of the Study

Prospective analytical.

Description of the Clinics

Both private clinics are located in the urban area of the city of Medellín, providing high complexity services with outpatient care, promotion and prevention programs, international patient healthcare, surgical specialties, clinical laboratory, imaging, hemodynamics, emergencies, hospitalization, and intensive care. Clinic A has 141 hospital beds in the general ward, 13 beds in the intensive care unit (ICU), 10 beds in the

special or intermediate care unit (SCU-IMCU), and 23 beds for managing COVID patients. For its part, clinic B has 175 hospital beds in the general ward, 15 beds in the intermediate respiratory care unit (IRCU), 8 beds in the ICU, and 22 beds in the COVID-ICU.

Eligibility Criteria

Adults with COVID-19 who required hospitalization. The case definition was a person with laboratory confirmation for COVID-19 infection, regardless of clinical signs and symptoms, according to RT-PCR SARS-CoV-2 (Amplification Kit Ref 09N77-090 according to Berlin protocol) in nasopharyngeal aspirate or swab. The criteria to define the need for hospitalization were applied by the physicians of the primary or emergency Health-Care Providing Institutions (IPS—Instituciones Prestadoras de Salud), based on the fulfillment of two or more of the following criteria: over 60 years of age, diabetes, cardiovascular disease (coronary artery disease or chronic heart failure), chronic lung disease (chronic obstructive pulmonary disease, emphysema, asthma), immunosuppression (prednisone > 20 mg/day for more than 14 days, methotrexate > 0.4 mg/kg/week, or biologic therapy), lymphopenia < 800 mm³, LDH > 350 IU/L, desaturation < 90%, hypoxemia with PAFI < 300 mm Hg, D-dimer > 1 mg/mL, elevated troponin I, EKG with prolonged QTc, ferritin > 1000 ng/mL, PCR > 10 mg/L, abnormal chest X-ray or computed tomography (basal consolidation, nodules, cavitation or pleural effusion).

Study Subjects

One hundred ninety-eight adult patients in clinic A, and 201 in clinic B, with a diagnosis of COVID-19 between March and August 2020. The population of patients in this study is highly selected, only those with certain risk factors were admitted and analysed; it reflects the reality of the epidemic in our country. Patients were hospitalized for two reasons: they had risk factors that made us think that their evolution was not going to be favourable, or despite not having these risk factors, their evolution was not adequate, and they worsened. No sample size calculation was applied since the total population of patients admitted during the study period was included.

Data Collection

The research committees of both clinics endorsed the research project and validated the protocol for extracting information from the medical records. The collection of sociodemographic and clinical data in each clinic was carried out by a doctor of the Infectious Diseases group working as a liaison, using an anonymized file (the name and ID number of each patient was replaced

by a numerical code) to guarantee the protection of the identity of each patient. Sociodemographic information, symptomatology, comorbidities, complications, hospital and ICU stay, mechanical ventilation, laboratory test, bacterial co-infections, treatment, and patient's discharge condition were extracted. The treatment of COVID-19 in our city greatly varied throughout the months of the study, according to the findings of different published protocols, which demonstrated the uselessness of lopinavir/ritonavir, azithromycin, hydroxychloroquine, and ivermectin, leaving only the use of dexamethasone given that in our country remdesivir or tocilizumab is not available.

Selection and information biases were controlled through the medical team's application of the case definition criteria and diagnostic tests with high validity (risk of false results tends to zero) following the manufacturer's criteria in reference laboratories endorsed by the National Institute of Health—Ministry of Health, and also by standardizing the data extraction work from the clinical history and logical verification (inconsistent data or data outside the measurement range of each variable was not reported).

Statistical Analysis

The categorical variables were described with (*n*) absolute and (%) relative frequencies. Their comparison was made with the Pearson's chi-square test (for nominal data), chi-square test for trend (for ordinal data), and Fisher's exact test (for dichotomous variables with an expected frequency less than 5). Continuous variables were described with summary measures (median and interquartile range) and were compared with the *Mann–Whitney U* test since the assumption of bivariate normality was not met, which was evaluated with the *Kolmogorov–Smirnov* test with *Lilliefors* correction. Factors associated with survival were identified with a Cox regression. The analyses were carried out in SPSS 27.0, taking *p* values less than 0.05 as significant.

Ethical Aspects

The study was approved by the Ethics and Scientific Committee of both clinics (Minutes 022 in “*Clínica CES*” and Minutes 11–2020 in “*Clínica Medellín Grupo QuironSalud*”), applying the guidelines of the Declaration of Helsinki, Resolution 8430 of the Ministry of Health of Colombia for health research, and Resolution number 1995 of 1999 that establishes the standards for the management of the Clinical History. It was classified as a risk-free study. Upon entering the clinical service, all patients signed an informed consent endorsing the use of clinical data for research purposes; as long as the clinic guarantees that such data is handled with

codes that protect the confidentiality and identity of the patient (anonymize the file for investigative purposes).

Results

In both clinics, the highest proportion of patients came from Medellín. However, this proportion was statistically higher in clinic B; also in this clinic, the percentage of patients diagnosed in primary IPS was statistically higher, compared to clinic A, where the majority of the patients came from the emergency service. There were no statistical differences in the percentage distribution of sex (Table 1).

On admission, the most frequent symptoms were cough (81%), dyspnea (79.9%), fever (79.4%), myalgias and arthralgias (72.9%), and less frequently nausea-vomiting (20.6%), dysgeusia (17.5%), and abdominal pain (11.0%) were recorded. All symptoms (except dysgeusia) showed statistically significant differences between both clinics (Table 1).

The most prevalent comorbidities were hypertension (41.6%), diabetes (23.8%), obesity (15.0%), hypothyroidism (13.0%), dyslipidemia (11.0%), and chronic lung disease (10.8%), which did not present statistically significant differences between the clinics (except hypertension). The other comorbidities presented prevalences of less than 10%, with statistically significant differences between the clinics (Table 2).

The most prevalent complications were bacterial pneumonia (18.8%), acute renal failure (ARF defined according to KDIGO criteria) without the need for renal replacement therapy (14.3%), and encephalopathy (9.5%), all with statistical differences according to the clinic. The other complications presented prevalences of less than 10% and were statistically similar between the clinics (Table 2).

In other relevant clinical outcomes, there were no statistically significant differences: (i) patients with hospitalization between 1 and 7 days corresponded to 53.0% in clinic A and 52.7% in clinic B; between 8 and 14 days, it was 27.8% in clinic A and 23.4% in B, and for hospitalizations of 15 or more days it was 19.2% in clinic A and 23.9% in B; (ii) 23.7% required mechanical ventilation in clinic A and 29.4% in clinic B; (iii) 25.3% were admitted to the ICU in clinic A and 32.3% in B; and (iv) deaths represented 7.1% in clinic A and 13.9% in clinic B (Fig. 1).

In the continuous variables analyzed in the study, there were statistically significant differences in D-dimer, which had a higher median in clinic A, and platelet and LDH values were higher in-clinic B patients (Table 3).

There were bacterial coinfections in 44% of the patients from clinic A and 56.2% from B. The antibiotic management of these infections did not show statistically significant differences between the two clinics, except for the prescription of ceftriaxone, cefepime, and ceftaroline, whose percentages of use were statistically higher in clinic B.

Table 1 Description and comparison of the sociodemographic characteristics and admission symptoms in both clinics

Sociodemographic characteristics and symptoms	Clinic A, <i>N</i> =198 % (<i>n</i>)	Clinic B, <i>N</i> =201 % (<i>n</i>)	<i>p</i> chi-square
Origin			
Medellín	63.1 (125)	81.6 (164)	< 0.001**
Other Metropolitan Area	34.8 (69)	13.9 (28)	
Outside the Metropolitan Area	2.0 (4)	4.5 (9)	
Place where the PCR diagnosis was made			
Primary IPS	39.4 (78)	74.1 (149)	< 0.001**
Emergency room	57.6 (114)	21.4 (43)	
Hospitalization	3.0 (6)	4.5 (9)	
Age group			
20–44 years	27.3 (54)	32.8 (66)	0.265
45–64 years	38.4 (76)	39.8 (80)	
65 or more	34.3 (68)	27.4 (55)	
Sex			
Female	42.9 (85)	39.3 (79)	0.462
Male	57.1 (113)	60.7 (122)	
Symptoms reported on admission			
Cough	87.9 (174)	74.1 (149)	< 0.001**
Dyspnea	89.4 (177)	70.6 (142)	< 0.001**
Fever	87.9 (174)	71.1 (143)	< 0.001**
Myalgia and arthralgia	63.1 (125)	82.6 (166)	< 0.001**
Odynophagia	59.6 (118)	27.4 (55)	< 0.001**
Diarrhea	28.8 (57)	18.4 (37)	0.015*
Ventilatory failure	29.3 (58)	16.9 (34)	0.003**
Nausea/vomiting	34.3 (68)	7.0 (14)	< 0.001**
Dysgeusia	16.7 (33)	18.4 (37)	0.648
Abdominal pain	14.6 (29)	7.5 (15)	0.022*

Source: The authors.

* $p < 0.05$; ** $p < 0.01$.

The proportion of deaths was 7.1% in clinic A with a mean survival of 51.9 days (95% CI=45–59); in clinic B, 13.9% of patients died with mean survival of 37.8 days (95% CI=32–43) which increases when adjusting for variables associated with outcome (Fig. 2). In the Cox regression, four variables associated with survival were identified, the clinic presented greater association strength: the risk of dying was 8 times higher in the patients seen at clinic B (Table 4).

Discussion

Colombia is one of the countries in South America where SARS-CoV-2 has had a very significant impact in terms of morbidity and mortality, as well as economic repercussions as a result of the confinement measures adopted by the government to try to mitigate the epidemic. After the virus's initial detection on March 6, 2020 [5], the infection has spread throughout the territory. However, little is known

about this group about the clinical profile of patients in the country [15, 16].

In this research, the clinical profile of adult patients hospitalized for COVID-19 in two clinics in the urban area of the city of Medellín was described. Simultaneously, a comparison was made of the prevalence of symptoms, comorbidities, complications, and other relevant medical outcomes, which allowed the identification of statistical differences in the multiple variables analyzed for both clinics. These findings can be explained by the socioeconomic and demographic differences of the populations they serve, which determine the populations' access to health services. While patients from clinic A came from a broader coverage area (Medellín and neighboring municipalities that make up the metropolitan area), those of clinic B came mostly from Medellín, making it easier for the majority of patients in clinic A to be admitted through the emergency service with more severe symptoms due to a more prolonged clinical course, denoting a more torpid evolution of the disease; Meanwhile, in clinic B, the patients consulted

Table 2 Description and comparison of comorbidities and complications in both clinics

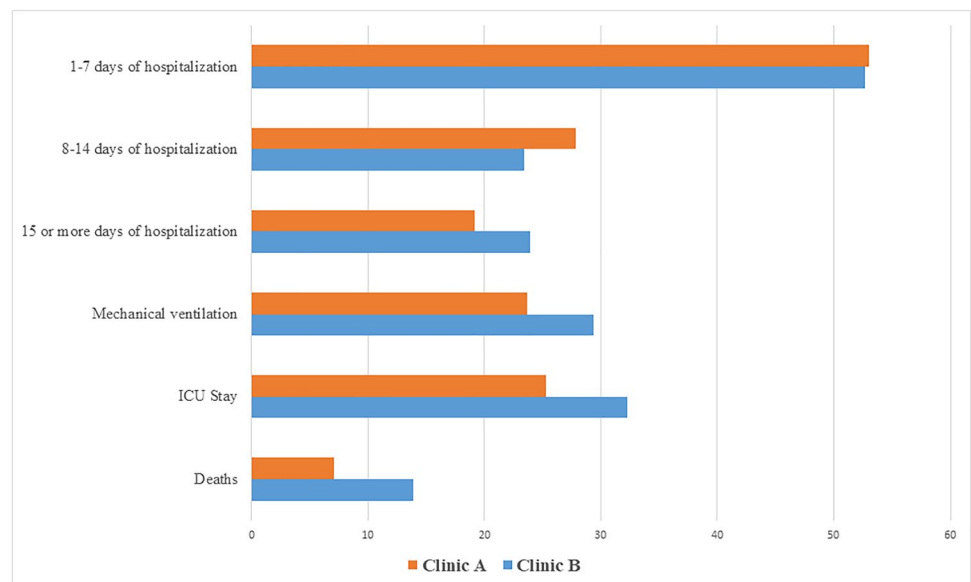
Comorbidities and complications	Clinic A, N= 198 % (n)	Clinic B, N=201 % (n)	p chi-square
Comorbidities			
Arterial hypertension	46.5 (92)	36.8 (74)	0.049*
Diabetes mellitus	21.7 (43)	25.9 (52)	0.330
Obesity	13.1 (26)	16.9 (34)	0.290
Hypothyroidism	13.6 (27)	12.4 (25)	0.722
Dyslipidemia	10.6 (21)	11.4 (23)	0.790
Chronic lung disease	12.6 (25)	9.0 (18)	0.237
Smoking	8.1 (16)	15.0 (30)	0.031*
Asthma	4.0 (8)	9.0 (18)	0.047*
Chronic kidney disease	7.6 (15)	2.5 (5)	0.020*
Heart failure	8.1 (16)	3.5 (7)	0.049*
Immunosuppression	7.1 (14)	1.5 (3)	0.006**
Complications			
Bacterial pneumonia	28.3 (56)	9.5 (19)	0.000**
ARF without renal replacement therapy	17.8 (35)	10.9 (22)	0.036*
ARF with renal replacement therapy	3.5 (7)	9.5 (19)	0.017*
Encephalopathy	16.7 (33)	2.5 (5)	0.000**
Polyneuropathy in critically ill patient	10.1 (20)	6.5 (13)	0.188
Catheter-related bacteraemia	4.5 (9)	6.0 (12)	0.524
Myocardial dysfunction and arrhythmias	8.1 (16)	7.0 (14)	0.673
Ogilvie syndrome and ischemia	1.0 (2)	3.5 (7)	0.091 ^a

Source: The authors.

* $p < 0.05$; ** $p < 0.01$.

^aFisher’s exact test.

Fig. 1 Percentage distribution (%) of the main clinical outcomes in both clinics. Source: The authors



through the outpatient services with milder symptoms and showing a more acute evolution. These circumstances were decisive when analyzing the reasons for the differences found in both institutions, despite being located in the same city. These findings then make it possible to reveal

the importance for each health institution to have their own evidence in order to guide clinical and public health decisions, as well as interventions aimed at slowing the progression of the infection, reduce hospitalization times, and improve recovery of patients, among other actions that

Table 3 Description and comparison of the study’s continuous variables in both clinics

Continuous variables	Clinic A, N=198 Me(RI) ^a	Clinic B, N=201 Me(RI) ^a	p Mann–Whitney U test
Days of hospital stay	7 (4–12)	7 (4–14)	0.358
Days of ICU stay	10 (5–22)	11 (7–18)	0.730
Days of symptoms prior to ICU admission	7 (5–9)	8 (6–10)	0.128
Days of mechanical ventilation	9 (3–21)	11 (7–18)	0.311
Hemoglobin (mg/dL)	14 (12–15)	14 (13–15)	0.596
Leukocytes/mm ³ (in thousands)	7.4 (5.7–11.6)	8.1 (6.2–11.4)	0.153
Lymphocytes/mm ³ (in thousands)	1.2 (0.8–1.6)	1.1 (0.7–1.5)	0.111
Platelets/mm ³ (in thousands)	212 (174–291)	251 (193–321)	0.044*
D-dimer (mg/mL)	626 (291–1 600)	506 (300–976)	0.043*
LDH (U/L)	313 (246–419)	361 (279–475)	0.002**
Ferritin (ng/mL)	827 (295–1942)	860 (445–1668)	0.156
Number of antibiotics	1 (1–2)	1 (1–2)	0.252
Days of antibiotic treatment	7 (5–10)	7 (4–10)	0.133

Source: The authors.

p* < 0.05; *p* < 0.01.

^aMedian and interquartile range.

Fig. 2 Comparison of survival in patients from both clinics. Source: The authors. Source: The authors

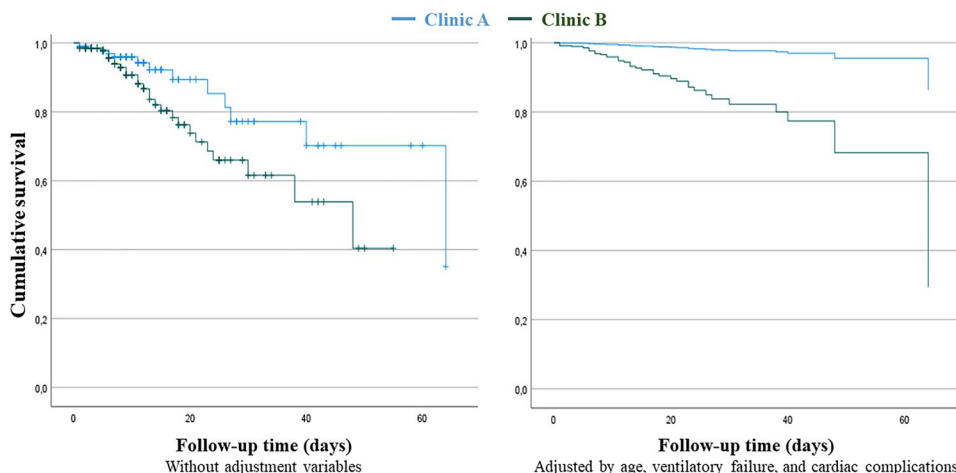


Table 4 Cox regression to identify variables associated with the risk of death for COVID-19

	B	SE	Wald	Hazard ratio HR (95%CI)
Clinic (B/A)	2.1	0.4	26.4	8.3 (3.71–18.70)**
Age (years)	0.1	0.0	24.8	1.1 (1.05–1.11)**
Ventilatory failure (yes/no)	1.5	0.4	14.6	4.6 (2.10–9.97)**
Myocardial dysfunction and arrhythmias (yes/no)	1.1	0.3	9.8	3.0 (1.52–6.10)**

Source: The authors.

***p* < 0.01.

ultimately make it possible to avoid sequelae and deaths, as well as reduce health-care costs.

In the analysis of the 399 confirmed cases of COVID-19 that required hospitalization, it is worth noting that the presence of comorbidities was statistically similar in the two clinics studied. The comorbidities with the highest prevalence were hypertension (41.6%), diabetes (23.8%), obesity (15.0%), hypothyroidism (13.0%), dyslipidemia (11.0%), and chronic lung disease (10.8%), similar to what was reported in other countries [17–19], where hypertension and diabetes are also the main comorbidities affecting adult patients who are hospitalized for COVID-19. It is also worth mentioning

that the percentages of these comorbidities in these countries were lower (21% and 10%), which implies that the population studied in Medellín had a higher probability of complications, derived from a higher prevalence of comorbidities.

It is necessary to mention that in the case of comorbidities with prevalences lower than 10%, such as smoking, asthma, kidney disease, heart failure, and immunosuppression, there were statistical differences between both clinics. These show that at least in these less prevalent clinical entities, there are clear differences in the populations that are cared for in each clinic, most likely related to socioeconomic, demographic, and access to health services conditions, but these are still similar to those reported in others countries [17–19]. Finally, they did not have a significant impact in terms of complications.

Furthermore, there were no differences found between the two clinics in terms of the days of hospitalization, mechanical ventilation, admission to the ICU, or the proportion of deaths. These findings have a lot to do with the equivalence found in comorbidities and the homogeneity of the care protocols used, which do not differ significantly from those reported in other countries [20, 21].

On the other hand, differences were found between the two clinics concerning symptoms. The most frequent symptoms in clinic A were cough (81%), dyspnea (79.9%), and fever (79.4%), similar to what was reported in other studies [22, 23], where these symptoms were also the most prevalent, with percentages of 78%, 52%, and 84%, respectively. The most prevalent complications in clinic A were bacterial pneumonia (18.8%), ARF (14.3%), and encephalopathy (9.5%), which when compared with other studies [24–26], corroborate that these are also the most prevalent, although with lower percentages than those found in the current study (pneumonia of 8% and ARF of 11%). In the case of the clinics studied, this is closely related to the socioeconomic and demographic conditions and conditions of access to health services of the populations treated in each clinic. Consequently, this defines the promptness with which the population consulted the different primary healthcare services, allowing the disease to evolve differently in both populations, which was evident in the type of symptoms and complications developed by the patients in each of the institutions analyzed.

Differences were also found in D-dimer, platelets, and LDH values, which suggested that there would be different outcomes related to these serological markers [27, 28]. However, this was not the case because platelets and LDH were higher in clinic B, while the D-dimer was found higher in clinic A, which was finally able to equate the outcomes, therefore, avoiding making the differences evident.

A significant percentage of patients with bacterial co-infections who received one or more antibiotics were found

(44% in clinic A and 56% in clinic B), which suggested that there would be large differences in the protocolized antibiotic management of each institution. However, no statistically significant differences were found between the two clinics, except for the prescription of ceftriaxone, cefepime, and ceftaroline, which were prescribed more in clinic B, as the hospital epidemiology, and microbiological cultures changed, as a result of the guidelines implemented as the pandemic progressed. All of these were expected to have a significant effect on the clinical outcome at the end; nevertheless, this did not happen in such a way, and in the patients studied, it is unknown whether these behaviors negatively impacted the bacterial resistance rates and/or hospital epidemiology, as it happened in other countries [29–31].

Finally, the factors associated with survival were clinic (HR 8.3), age (HR 1.1), ventilatory failure (HR 4.6), and myocardial dysfunction and arrhythmias (HR 0.03), which differs from a study from Brazil that reported association with elderly (HR 3.6), neurological diseases (HR 3.9), pneumopathies (HR 2.6), and cardiovascular diseases (HR 8.9), and a meta-analysis that highlighted to individuals with underlying cardiometabolic disease [32, 33•].

It should be noted that the clinic presented the greatest association strength, which corroborates the hypothesis of this study, that is, even in patients hospitalized in the same city and attended with similar protocols, there are differences in survival and clinical profile. This shows several relevant issues: (i) the need to carry out local studies since the evidence from other institutions is not easily extrapolated, (ii) it is necessary to know the clinical-epidemiological profile of each hospital to improve the care of patients with the disease, (iii) the disparities in survival and the clinic characteristics demonstrate the importance of expanding the studies on the social determinants of health that could explain such differences and allow the identification of areas of inter-sectoral action (clinical, epidemiological, public health, social, economic).

Among the limitations of this study, it stands out the difficulty of analyzing some socioeconomic determinants of the studied populations, which could explain the differences in both clinics' profiles since this type of information is not recorded in the clinical history and is difficult to obtain from hospitalized patients (some unstudied factors could be confounding factors). Despite this limitation, this study demonstrates the importance for each health institution that treats this type of patients to have their own evidence in order to guide clinical and public health decisions, as well as interventions aimed at slowing the progression of the infection, reduce hospitalization times, and improve recovery of patients, among other actions that ultimately make it possible to avoid sequelae and deaths.

Conclusion

There is a high proportion of nonspecific symptoms, comorbidities, complications, admission to the ICU, mechanical ventilation, and death in connection to patients diagnosed with COVID-19 and who met hospitalization criteria in two clinics in the urban area of Medellín. Most of these outcomes presented statistical differences between the two clinics, evidencing the heterogeneity of the survival and the clinical profile of these types of patients, who, although they come from the same city, have marked differences. These findings demonstrate the need to conduct unique studies for each institution, which poses a significant challenge for hospital epidemiology programs due to the impossibility of extrapolating evidence from other healthcare institutions and the need to apply personalized medicine programs given the clinical diversity of patients hospitalized for COVID-19.

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Declarations

Conflict of Interest The authors declare no competing interests.

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Papers of particular interest, published recently, have been highlighted as: ● Of importance. ●● Of major importance.

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