



## Epidemiology of SARS-CoV-2 in the southeast region of Brazil

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### Introduction

In December 2019, a new coronavirus was detected in Wuhan, China, named SARS-CoV-2, which soon spread across the world, being classified as a pandemic in January 2020 by the World Health Organization (WHO) [1-4].

Usually, the infection caused by SARS-CoV-2 attacks the upper and lower respiratory tract [5], and may lead to a severe acute respiratory syndrome (SARS) [1,3,6]. As of August 2021, there were 213,813,516 confirmed cases and 4,461,982 deaths around the world. Brazil is one of the most important epicenters of COVID-19 disease, reaching 20,614,866 confirmed cases and 575,742 deaths [7]. The São Paulo state was one of the most affected locations, due to its higher population density, presenting 4,253,516 confirmed cases and 145,522 deaths [8]. Currently, the largest mortality rates caused by SARS-CoV-2 are associated with elderly people, and the presence of comorbidities and deficiencies of the immune system [9].

The COVID-19 virus spreads among humans through contact with oro-nasal secretions [10,11], such as droplets of saliva or discharge from the nose during cough and sneeze [12]. Due to its rapid spread it is indispensable the use of simple control measures to contain the pandemic, as the use of masks, disinfection of hands with soap/alcohol 70%, social distance, and vaccination. SARS-CoV-2 transmission usually occurs up seven days from the first symptoms are detected [13,14], while the estimated incubation period is from five days to two weeks, with the possibility of transmission by asymptomatic individuals [15,16].

The wide diversity of socioeconomic, climatic and geographic characteristics of Brazil is critical to define

the profile of the most vulnerable population. So far, no studies have demonstrated the correlation between the epidemiological history and the main symptoms diagnosed individuals. Therefore, here we have chosen the Southeast region of Brazil, which presents the greatest number of COVID-19 cases, and showed the correlation between epidemiological features and symptoms.

Therefore, this study aimed to investigate the main epidemiological variables associated with death in a population individuals notified with severe acute respiratory syndrome (SARS) in the capital cities of states from of the Southeast region of Brazil from 2020 to 2021. Moreover, the study intends to describe, the correlate symptomatology, the association between chronic disease and COVID-19, as well as the presence of chronic disease and death caused by COVID-19 complications.

### Methods

As this is a retrospective study, analyzing secondary data obtained from public data sources (SIVEP influenza - Influenza Epidemiological Surveillance Information System), available at: <https://opendatasus.saude.gov.br/dataset>, this study did not require an evaluation by the Research Ethics Committee, according to the Resolution 466/2012 - CNS/MS.

The epidemiology of SARS infection was described from patients reported in the capitals of the Southeastern Brazil, from May 2020 to May 2021, through review of the SARS notification forms of the SIVEP flu database, synthesized in the form of a

spreadsheet system, with all fields of the notification form from the Health System.

The eligibility criteria were established included samples from individuals notified for COVID-19 disease, with positive RT-qPCR, presenting more than 15 years old, and exhibiting the outcome of the disease as cure or death. Individuals who did not perform the RT-qPCR laboratory test or presented incomplete forms were excluded from the analyses.

### Statistical Analysis

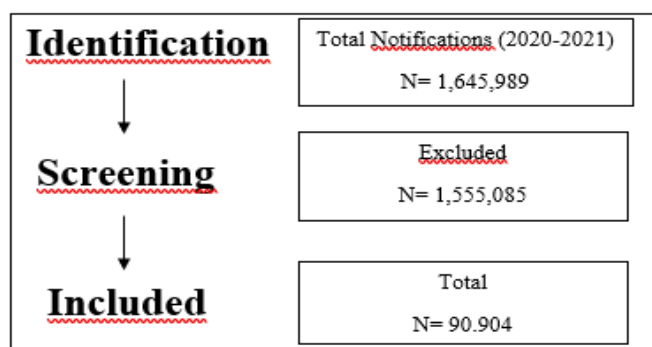
The data were filtered and the statistical analyses were performed using SPSS Statistics statistical software v. 27.0. The significance level adopted was 5%.

### Results and Discussion

The SARS-CoV-2 pandemic led the Epidemiological Surveillance System to make changes in the way of notifying respiratory diseases in early 2020, including COVID-19 disease. The SIVEP influenza database is used by the epidemiological surveillance of state and municipal authorities to insert the records of SARS cases and it is available at <https://opendatasus.saude.gov.br/dataset/bd-srag-2021>.

From May 2020 and May 2021, SIVEP generated a spreadsheet composed by 1,645,989 reported cases for COVID-19 in Brazil. In this study, filters were applied in order to follow the eligibility criteria. After refinement of the initial table, the number of samples included in this study were 90,904 (Figure 1).

Figure 1. Sample selection flowchart.



This epidemiological background allowed us to study aspects of the notified adolescent-adult population per each state from Southeastern Brazil. The evaluated variables were sex, main symptoms, comorbidities, and disease outcome (death or cure). Here, we showed that the largest number of cases were notified in the capital of São Paulo stated, about 61% cases, which can be associated with the fact of São

Paulo city to be the biggest metropolis in the country. The predominance of infected males 55% over females is similar to other countries [17]. The most prevalent symptoms, such as dyspnea 79.2%, cough 79% and change in the oxygen saturation 75.1% present in the notifications were correlated with the criteria for case determination of SARS by the epidemiological surveillance.

Besides, among the comorbidities analyzed, the heart disease was displayed in 40,4% of the cases, which can be related with hypertension or venous thrombosis. We showed that the lethality was observed in 30.6% of the analyzed cases, which could be associated with several factors, such as high virulence of the disease, comorbidities, absence of vaccination during the study period, among others (Table 1).

Table 1. Distribution of demographic characteristics in the general population presenting severe acute respiratory syndrome due to COVID-19, from 2020 to 2021, from Southeastern Brazil.

Variables	%	N
<b>Southeast region</b>		
<i>Espírito Santo - ES</i>	1.2	1,131
<i>Belo Horizonte - BH</i>	12.7	11,591
<i>Sao Paulo-SP</i>	61.0	55,473
<i>Rio de Janeiro - RJ</i>	25.0	22,709
<b>Sex</b>		
<i>Masculine</i>	55.0	50,059
<i>Feminine</i>	45.0	40,834
<b>Symptoms</b>		
<i>Fever</i>	70.9	53,754
<i>Cough</i>	79.0	61,479
<i>Dyspnea</i>	79.2	61,420
<i>O<sub>2</sub>* Saturation &lt; 95%</i>	75.1	55,236
<b>Comorbidities</b>		
<i>Diabetes</i>	27.1	24,612
<i>Heart disease</i>	40.4	36,751
<i>Obesity</i>	7.4	6758
<b>Outcome</b>		
<i>Cure</i>	68.5	58,097
<i>Death</i>	30.6	26,026

\*O<sub>2</sub> - Oxygen

As this is a descriptive study, which uses secondary data analysis, the option "ignored" present in most fields of the notification form, and that was ticked several times in the answers, could have influenced the results of this study. This fact can be explained due to the high demand for cases to be notified by the institutions, reduction of qualified human resources in fill in the forms, or subjectivity of the investigated form item. However, it is worth noting that this occurrence did not harm the statistical analysis, due to the expressive

number evaluated data.

In the period of the study, the vaccine for COVID-19 was in testing phase, therefore these results can provide an overview prior to the preventive intervention. Studies of this magnitude can encourage further research that cover more regions of the country in order to better develop national databases, as well as public policies in the Health Services.

## Conclusion

Comorbidities are risk factors that may be associated with hospitalization for COVID-19. Although COVID-19 has a wide spectrum of symptoms, its aggravation implies in several measures when referring to the management of human and financial resources, dimensioning of equipment and hospital beds, both in private and public medicine. Our study can be used as a starting point for future comparisons in different regions of Brazil and other countries. The data obtained here can provide important clues for future understanding of prevention and control of COVID-19 in individuals around the world.

**Keywords:** Epidemiology. SARS-CoV-2. Southeast. Region. Brazil.

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Nil.

## Ethics approval

This study did not require an evaluation by the Research Ethics Committee, according to the Resolution 466/2012 - CNS/MS.

## Informed consent

Not applicable.

## Funding

Not applicable.

## Data sharing statement

No additional data are available.

## Conflict of interest

The authors declare no conflict of interest.

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