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# Epidemiology description of COVID-19 in Brazil: across-sectional analysis

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## ABSTRACT

After the first weeks of the COVID-19 outbreak, in China, many cases were detected worldwide in several countries. The SARS-CoV-2 has a high transmissibility and, an acceleration of the case detections among weeks 9 to 11, were notified. The objectives were evaluating the incidence rate, the epidemiological comorbidities and mortality due to SARS-CoV-2 outbreak in Brazil. Methods: a cross-sectional study based on secondary data, extracted from Epidemiological Bulletins (EB) of Brazil Ministry of Health, among weeks 01 to 46 were analyzed. The consult was done until November 11, 2020. Results: Were confirmed a total of 5,599,951 COVID-19 cases. The highest record in the number of new cases (319,653) and new deaths (7,677 deaths), occurred on Epidemiologic Week 31. In total, 841,547 people were hospitalized with SARS, of which 54.1% were due to COVID-19. The ages ranged from <1 year to 90 years old or more and, the highest rate was among the 60 to 69 years old (93.8%). Among these cases, the male was the most affected, adding a total of 255,946. Conclusion: Brazil has reducing its cases of COVID-19 that demonstrates the acute phase of the pandemic is diluting. Brazilian society has managed to live with the disease and the health crisis looks are being overcome.

## INTRODUCTION

Two outbreaks of coronavirus respiratory syndromes, have been described during XXI century, presenting two new virus types, one of the viral types caused the acute severe respiratory syndrome (SARS-CoV), during the period from 2002 to 2004 and, the other viral type, caused the syndrome respiratory system, known as the Middle East (MERS-CoV), this virus type began in 2012 [1-2].

At the end of 2019, in Wuhan (China), there was an unusual outbreak of pneumonia in hospitalized patients. After the exams, it was detected that the pathogen caused this disease was called coronavirus-2, which is related to severe acute respiratory syndrome (SARS-CoV-2). The etiologic agent of the disease COVID-19 is the seventh coronavirus recognized for infecting humans [1-4].

After its recognition, the COVID-19 virus, spread exponentially and increased worldwide, the number of cases. After the first weeks of the COVID-19 outbreak, in China, cases were detected worldwide in several countries and, an acceleration of the case detections among weeks 9 to 11, at the beginning of the outbreak [1-5].

The U.S. Center for Disease Control and Prevention (CDC), on January 20, 2020, mobilized emergency operations in the face of the public health-related threat caused by COVID-19. At the end of January 2020, the World Health Organization spoke out, claiming that the outbreak, caused by COVID-19, was a Public Health Emergency of international concern and, after six weeks, the World Health Organization, distinguished the outbreak as an epidemic. Currently, infection by Coronavirus-2 of the Severe Acute Respiratory Syndrome (SARS-CoV-2), provided the second pandemic of the XXI century, being surpassed only by the pandemic caused by the *Influenza A* virus in 2009 year [6-8].

In Brazil, the Public Health Emergency Operations Center, created as a support for the new Coronavirus (COE-nCoV), began on January 22, 2020. Epidemiological surveillance for COVID-19 infection, was being outlined from World Health Organization information, strategies in other countries and, new technical and scientific evidence published, seeking to build on existing actions for notification, registration, investigation, management and adoption of preventive measures, similar to the knowledge accumulated in SARS-CoV, MERS -CoV and 2019-nCoV, which never occurred in Brazil, in addition to surveillance plans for Severe Acute Respiratory Syndrome (SRAG) and Flu Syndrome (SG) [9].

On February 3rd, 2020, the Brazilian Ministry of Health, declared a Public Health Emergency of National Importance (ESPIN), due to human infection with the new Coronavirus (2019-nCoV), through epidemiological surveillance regulations, but the first case suspected of COVID-19 from Brazil, was notified on January 22 and, that it met the case definition. On March 11, 2020, the World Health Organization classified Coronavirus Disease 2019 (COVID-19) as a pandemic [9].

SARS-CoV-2 has a high transmissibility power, due to its unique virologic characteristics. Its transmission occurred mainly after the onset of the disease, producing a peak after the severity of the disease. However, samples from the upper respiratory tract demonstrated a higher viral load of SARS-CoV-2 during the first week of symptoms and, therefore, the risk of spreading the virus through the pharynx was very high at the beginning of the infection. The virus spreads through the droplets during the speech of a patient with COVID-19 and, aerosol particles that are much smaller and much more numerous can also be seen, remaining in the air for a long time, penetrating deeply into the lungs, when inhaled by the next person [10-14].

Data on the pandemic worldwide are being described by Epidemiological Week (EW) that is a basic element for using the time variable in health surveillance. This surveillance data includes the description and comparison of disease patterns using variables of person, place, and time, grouping deaths or other epidemiological events. One way to standardize the time variable for the purposes of epidemiological surveillance, the 365 days of the year were divided in 52 or 53 epidemiological weeks, becoming the epidemiological calendar, with those of previous years and facilitates the comparison among countries. Epidemiological weeks begin on Sunday and end on Saturday [15].

In the Ministry of Health's epidemiological bulletin, BRAZIL, data from EW 43 confirmed 42,310,352 cases of COVID-19 worldwide. Brazil ranked third in the number of cases (5,380,635) behind only of the United States in first place with the highest number of accumulated cases (8,493,669), followed by India (7,814,682), Russia (1,480,646) is right behind Brazil, then Argentina (1,069,355), another country in South America, which borders Brazil. Regarding deaths, 1,145,394 were confirmed worldwide until October 24. The United States was the country with the highest cumulative number of deaths (223,995), followed by Brazil (156,903), India (117,956), Mexico (88,312) and the United Kingdom (44,571) [16].

In Brazil, up to 15 EW, 9,056 cases of COVID-19 were confirmed, and in the last 24 hours, 1,146 new cases of the disease were confirmed, representing an increase of 15% (1,146/7,910) concerning the accumulated total until the day previous [17]. The objective of this study was to evaluate the incidence rate and its epidemiological distribution by age, sex, comorbidities, risk factor and mortality due COVID-19 outbreak in Brazil.

## MATERIALS AND METHODS

This is a descriptive study conducted based on secondary data extracted from epidemiological bulletins (EB), among weeks 01 to 46, the Ministry of Health on COVID-19, consulted until November 11, 2020. The bulletins were chosen because they come from Ministry of Health source, with complete information on the variables analyzed of this study. Other sources of official information were also used, such as the websites of the World Health Organization (WHO), Pan American Health Organization (PAHO) and, the Epidemiological Surveillance Guides to complement the information.

For the description of the epidemiological profile of confirmed cases of the variables used for the research, such as: age, sex, risk factor, information composed in these bulletins was used. Then, the incidence and mortality rates were organized in tables, according to the region.

On the website of the Brazilian Ministry of Health, the data are presented on a consolidated basis, with total omission of the identity of the subjects associated with them. For this reason, the study was conducted without the project having to be analyzed by an Ethics in Research Committee.

### Statistical analysis

To determine proportions among groups, the Odds Ratio (OR) test was considered, it is a test for proportions arranged in a contingency table, it evaluates if there is a higher proportion in one group, when compared to the other, it was possible to determine the proportion of deaths in Southeast Brazil, in relation to the other regions. Likewise, it was possible to assess the American continent in relation to the others and determine whether there was an increase in deaths in the European continent, according to the updated data from the epidemiological week 46. For the assessment of the proportion of deaths in one region, in relation to the other, the number of deaths (assessed event) and, the number of undead as failure, were considered as successful. With the test, it was possible to compare the SARS caused by COVID-19, with the SARS caused by the *Influenza A* virus, other viruses and other agents, determining age and sex as assessment factors, considering the individuals with the target age as success (evaluated event) and, individuals with other ages unsuccessful, adopting the same logic for sex. For significance of the obtained results, a significance limit of 5% ($p<0.05$) was considered. The statistics were performed with

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the aid of the BioEstat® 5.3 and STATA® 16.0 software.

## RESULTS

Were describes the total confirmed cases, recovered and deaths by COVID-19 in the world, by continental region until EW 46 (To check the epidemiological weeks through the months, see Table 1 S).

**Table 1s.** Epidemiological calendar 2020 used by the Health Surveillance Secretariat of Health Ministry.

| Epidemiologic week | | | | | |
|---|---|---|---|---|---|
| 1 | 12-29-2019 | 01-04-2020 | 28 | 07-05-2020 | 07-11- 2020 |
| 2 | 01-05-2020 | 01-11-2020 | 29 | 07-12-2020 | 07-18- 2020 |
| 3 | 01-12-2020 | 01-18-2020 | 30 | 07-19-2020 | 07-25- 2020 |
| 4 | 01-19-2020 | 01-25-2020 | 31 | 07-26-2020 | 08-01- 2020 |
| 5 | 01-26-2020 | 02-01-2020 | 32 | 08-02-2020 | 08-08- 2020 |
| 6 | 02-02-2020 | 02-08-2020 | 33 | 08-09-2020 | 08-15- 2020 |
| 7 | 02-09-2020 | 02-15-2020 | 34 | 08-16-2020 | 08-22- 2020 |
| 8 | 02-16-2020 | 02-22-2020 | 35 | 08-23-2020 | 08-29- 2020 |
| 9 | 02-23-2020 | 02-29-2020 | 36 | 08-30-2020 | 09-05- 2020 |
| 10 | 03-01-2020 | 03-07-2020 | 37 | 09-06-2020 | 09-12- 2020 |
| 11 | 03-08-2020 | 03-14-2020 | 38 | 09-13-2020 | 09-19- 2020 |
| 12 | 03-15-2020 | 03-21-2020 | 39 | 09-20-2020 | 09-26-2020 |
| 13 | 03-22-2020 | 03-28-2020 | 40 | 09-27-2020 | 10-03-2020 |
| 14 | 03-29-2020 | 04-04-2020 | 41 | 10-03-2020 | 10-10-2020 |
| 15 | 04-05-2020 | 04-11-2020 | 42 | 10-11-2020 | 10-17-2020 |
| 16 | 04-12-2020 | 04-18-2020 | 43 | 10-18-2020 | 10-24-2020 |
| 17 | 04-19-2020 | 04-25-2020 | 44 | 10-25-2020 | 10-31-2020 |
| 18 | 04-26-2020 | 05-02-2020 | 45 | 11-01-2020 | 11-07-2020 |
| 19 | 05-03-2020 | 05-09-2020 | 46 | 11-08-2020 | 11-14-2020 |
| 20 | 05-10-2020 | 05-16-2020 | 47 | 11-15-2020 | 11-21-2020 |
| 21 | 05-17-2020 | 05-23-2020 | 48 | 11-22-2020 | 11-28-2020 |
| 22 | 05-24-2020 | 05-30-2020 | 49 | 11-29-2020 | 12-05-2020 |
| 23 | 05-31-2020 | 06-06-2020 | 50 | 12-06-2020 | 12-12-2020 |
| 24 | 06-07-2020 | 06-13-2020 | 51 | 12-13-2020 | 12-19-2020 |
| 25 | 06-14-2020 | 06-20-2020 | 52 | 12-20-2020 | 12-26-2020 |
| 26 | 06-21-2020 | 06-27-2020 | 53 | 12-27-2020 | 01-02-2021 |
| 27 | 06-28-2020 | 07-04-2020 | Source: Sinan/MS | | |

The American and European continents had 21,842,460 and 13,576,687 cases confirmed by COVID-19, respectively. Considering the number of deaths, the American continent, when compared to the other continents, presented 1.4 times more

than the Western Pacific region with OR=1.46 (1.44-1.48, p<0.0001), 1.3 times more than in the African continent with OR=1.35 (1.33-1.37, *p*<0.0001), 1.2 times more than in the Mediterranean region Eastern, with OR=1.19 (1.18-1.20, *p*<0.0001), 2 times more than in the Southeast Asia region, with OR=1.98 (1.97-1.99, *p*<0.0001). However, the European continent had a proportionally higher number of deaths than the American continent, with OR=3.09 (3.08-3.11, *p*<0.0001) (Table 1).

**Table1.** Distribution of records of confirmed cases, recovered cases and deaths confirmed by COVID-19 until the epidemiological week 46. Worldwide distribution according continental region.

| Location | Confirmed cases | Recovered cases | Deaths |
|---|---|---|---|
| World | 50,676,072 | 49,414,997 | 1,26,1075 |
| African Region | 1,368,904 | 1,338,109 | 30,795 |
| Region of the Americas | 21,842,460 | 21,181,954 | 6,60,506 |
| European Region | 13,576,687 | 3,282,870 | 3,17,204 |
| Eastern Mediterranean Region | 3,368,738 | 3,282,870 | 85,868 |
| Western Pacific Region | 774,791 | 758,640 | 16,151 |
| Southeast Asia Region | 9,743,751 | 9,593,213 | 1,50,538 |
| Source: WHO (2020) | | | |

The Ministry of Health received notification of the first confirmed case of COVID-19 in Brazil on February 26, 2020. From February 26 to November 11, 2020. A total of 5,599,951 COVID-19 cases, were confirmed in Brazil. The highest record in the number of new cases (319,653 cases) (Figure 1) and new deaths (7,677 deaths) (Figure 2) occurred in EW 30. During EW 45, a total of 54,420 cases and 1,222 new deaths by COVID-19, were recorded in Brazil. The incidence rate for COVID-19, until 4 November 2020, was 2,660.1 cases per 100 thousand inhabitants, while the mortality rate was 76.7 deaths per 100 thousand inhabitants.

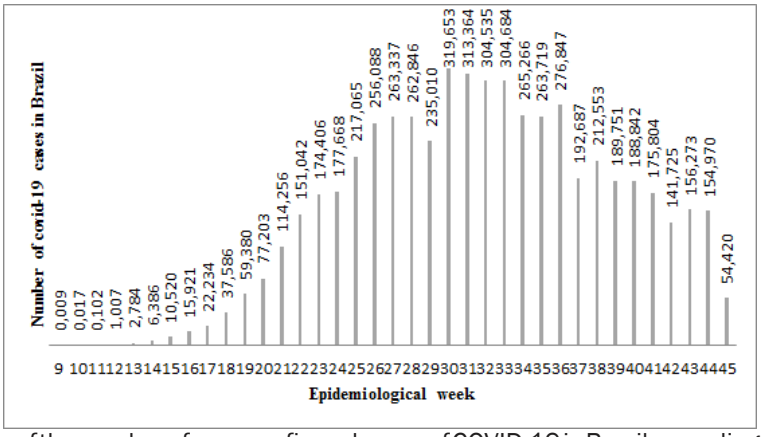


**Figure 1.** Evolution of the number of new confirmed cases of COVID-19 in Brazil according epidemiological week.

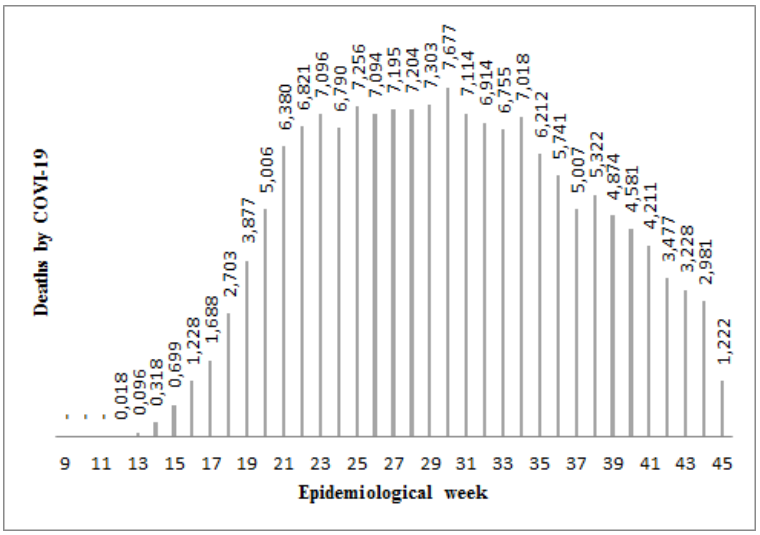


**Figure 2.** Evolution of the number of new confirmed COVID-19 deaths in Brazil according epidemiological week.

The temporal evolution of confirmed cases and deaths related to COVID-19, varied among regions of the country. In epidemiological week 45, the number of COVID-19 confirmed, was 1,957,496 in the Southeast of Brazil, 1,487,853 in the

Northeast, 736,175 in the South of Brazil, 700,593 in the Midwest and 707,908 in the North of the country. The number of deaths in the same period was 73,261 in the Southeast, 42,480 in the Northeast, 14,966 in the Center-West, 14,335 in the South and 16,064 in the North of Brazil (Table 2).

**Table2.** Distribution of case and death records confirmed by COVID-19, incidence/100 thousand in habitants and mortality/100 thousand inhabitants until the epidemiological week 45. Distribution in Brazil and by region.

| Location | Confirmed cases | Deaths | Incidence/100 thousand inhabitants | Mortality/100 thousand inhabitants |
|---|---|---|---|---|
| Brazil | 5,590,025 | 161,106 | 2,660.1 | 76.7 |
| South | 736,175 | 14,335 | 2,455.9 | 47.8 |
| Midwest | 700,593 | 14,966 | 4,298.9 | 91.8 |
| Southeast | 1,957.496 | 73,261 | 2,215.1 | 82.9 |
| Northeast | 1,487.853 | 42,480 | 2,607 | 74.4 |
| North | 707,908 | 16,064 | 3,840.9 | 87.2 |
| Source: SVS/MS | | | | |

The Southeast region had a higher number of deaths, being approximately 2 times more than in the South, with OR=1.95 (1.92-199, $p$<0.0001), 1.8 times more than in the Midwest, with OR=1.78 (1.74-1.81, $p$<0.0001), 1.7 times more than in the North, with OR=1.67 (1.64-1.70, $p$<0.0001) and 1.3 times more than in the Northeast with OR=1.32 (1.30-1.33, $p$<0.0001). Based on Table 2, the North region recorded an incidence coefficient of 3,840.9 cases/100 thousand inhabitants, simultaneously registering a mortality of 87.2 deaths/100 thousand inhabitants. The Northeast region had an incidence of 2,607.0 cases/100 thousand inhabitants and a mortality of 74.4 deaths/100 thousand inhabitants. In the Southeast region, the incidence coefficient was 2,215.1 cases/100 thousand inhabitants and the mortality of 82.9 deaths/100 thousand inhabit. The South region recorded an incidence of 2,455.9 cases/100 thousand inhabitants and, a mortality rate of 47.8 deaths/100 thousand inhabitants. Finally, the Midwest region, which had the highest incidence and mortality in the country, until EW 45, had an incidence of 4,298.9 cases/100 thousand inhabitants and 91.8 deaths/100 thousand inhabit.

The Table 3 shows the notified cases of Severe Acute Respiratory Syndrome (SARS) hospitalized until EW 43 (10/18/2020 - 24/10/2020). A total of 841,547 SARS notifications were recorded and 455,062 cases were confirmed for COVID-19, were notified 54.1% cases in Brazil.

**Table 3.** Cases of hospitalized SARS reported according to final classification and epidemiological week 43.

| SARS | Absolute number | Percentage % |
|---|---|---|
| COVID-19 | 455,062 | 54.1 |
| *Influenza A* virus | 2,538 | 0.3 |
| Other respiratory viruses | 3,531 | 0.4 |
| Other etiologic agents | 2,196 | 0.3 |
| Not specified | 297,266 | 35.3 |
| Under investigation | 80,954 | 9.6 |
| TOTAL | 841,547 | 100 |
| Source: SVS/MS | | |

Among the cases of SARS, 459,150 (54.6%) occurred in males and the age group with the highest number of reported cases is 60 to 69 years old with 156,290 (18.6%) cases. In relation to cases of SARS by COVID-19, 255,946 (56.2%) occurred in male and the most affected age group remained as 60 to 69 years old with 93,800 (20.6%) (Table 4).

**Table4.** Severe Acute Respiratory Syndrome (SARS) hospitalized, according to final classification, age group and sex until epidemiological week 43

| Age range (in years) | COVID-19 | *Influenza A* virus | Other respiratory viruses | Other etiologic agents | Not specified | Under investigation | Total |
|---|---|---|---|---|---|---|---|
| <1 | 2,780 | 155 | 995 | 46 | 11,107 | 2,376 | 17,459 |
| 1 to 5 | 3,018 | 418 | 1,052 | 90 | 18,524 | 4,001 | 27,103 |
| 6 to 19 | 5,,564 | 276 | 277 | 95 | 14,865 | 3,475 | 24,552 |
| 20 to 29 | 17,638 | 250 | 157 | 155 | 16,486 | 4,312 | 38,998 |
| 30 to 39 | 44,307 | 279 | 190 | 204 | 24,584 | 7,385 | 76,949 |
| 40 to 49 | 64,079 | 228 | 139 | 233 | 29,277 | 952 | 103,608 |
| 50 to 59 | 83,243 | 259 | 171 | 309 | 38,478 | 12,387 | 134,847 |
| 60 to 69 | 93,800 | 249 | 193 | 356 | 47,560 | 14,132 | 156,290 |
| 70 to 79 | 79,556 | 220 | 171 | 337 | 48,365 | 12,532 | 141,181 |
| 80 to 89 | 49,203 | 156 | 137 | 293 | 37,288 | 8,532 | 95,609 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 90 or more | 11,874 | 48 | 49 | 78 | 10,732 | 2,170 | 24,951 |
| Gender | | | | | | | |
| Male | 255,946 | 1,294 | 1,890 | 1,219 | 155,575 | 43,226 | 459,150 |
| Female | 199,015 | 1,242 | 1,637 | 977 | 141,564 | 37,684 | 382,119 |
| Ignored | 101 | 2 | 4 | 0 | 127 | 44 | 278 |
| General total | 455,062 | 2,538 | 3,531 | 2,196 | 297,266 | 80,954 | 841,547 |
| Source: SVS/MS | | | | | | | |

The proportional comparison of SARS among COVID-19, *Influenza*, other respiratory viruses, and other etiological agents according to age. It showed a higher proportion of SARS by COVID-19 after 40 years of age, with emphasis on the age range of 60 to 69 years, where the comparison among COVID-19 and *Influenza* pointed OR=2.38 (2.09-2.72, $p<0.0001$). Likewise, comparisons with other viruses and other etiologic agents showed OR=4.49 (3.88-5.19, $p<0.0001$) and OR=1.34 (1.19-1.50, $p<0.0001$), respectively. However, the proportion of individuals under 40 years of age is higher in cases of SARS due to influenza, other viruses and other etiologic agents, with emphasis on the interval age of 1 to 5 years of age, where individuals in this range age groups pointed to *Influenza* OR=29.53 (26.43-32.99, p<0.0001), other viruses OR=63.83 (58.64-68.89, $p<0.0001$) and other etiologic agents OR=6.40 (5.16-7.92, $p<0.0001$) (Table 5).

**Table 5.** Comparison among COVID-19 and other etiologic agents of SARS according to age and sex.

| | COVID-19 vs. influenza | COVID-19 vs. another virus | COVID-19 vs. Other etiological agents |
|---|---|---|---|
| Age | OR CI95% | OR CI95% | OR CI95% |
| <1 | 10.58 (8.95-12.50 $p<0.0001$) | 63.83 (58.79-69.30 $p<0.0001$) | 3.48 (2.59-4.67 $p<0.0001$) |
| 1 to 5 | 29.53 (26.43-32.99 $p<0.0001$) | 63.83 (58.64-68.89 $p<0.0001$) | 6.40 (5.16-7.92 $p<0.0001$) |
| 6 to 19 | 9.85 (8.67-11.20 $p<0.0001$) | 6.87 (6.06-7.79 $p<0.0001$) | 3.65 (2.96-4.49 $p<0.0001$) |
| 20 to 29 | 2.70 (2.37-3.09 $p<0.0001$) | 1.15 (0.98-1.35, $p=0.08$) | 1.88 (1.59-2.21 $p<0.0001$) |
| 30 to 39 | 1.14 (1.01-1.29 $p=0.03$) | 1.89 (1.63-2.19 $p<0.0001$) | 1.05 (0.91-1.21 $p=0.50$) |
| 40 to 49 | 1.66 (1.44-1.90 $p<0.0001$) | 3.99 (3.37-4.73 $p<0.0001$) | 1.38 (1.20-1.58 $p<0.0001$) |
| 50 to 59 | 1.97 (1.73-2.24 $p<0.0001$) | 4.39 (3.77-5.13 $p<0.0001$) | 1.36 (1.21-1.54 $p<0.0001$) |
| 60 to 69 | 2.38 (2.09-2.72 $p<0.0001$) | 4.49 (3.88-5.19 $p<0.0001$) | 1.34 (1.19-1.50 $p<0.0001$) |
| 70 to 79 | 2.23 (1.94-2.56 $p<0.0001$) | 4.16 (3.56-4.85 $p<0.0001$) | 1.16 (1.04-1.31 $p=0.009$) |
| 80 to 89 | 1.85 (1.57-2.17 $p<0.0001$) | 3.00 (2.53-3.56 $p<0.0001$) | 1.27 (1.12-1.43 $p=0.0002$) |
| ≥ 90 | 1.38 (1.04-1.85 $p=0.02$) | 1.90 (1.43-2.52 $p<0.0001$) | 1.37 (1.09-1.72 $p=0.007$) |
| Gender | | | |
| Male | 1.23 (1.14-1.33 $p<0.0001$) | 22.72 (19.62-26.31 $p<0.0001$) | 1.03 (0.94-1.12 $p=0.50$) |
| Female | 1.23 (1.14-1.33 $p<0.0001$) | 1.11 (1.04-1.18 $p=0.001$) | 0.96 (0.89-1.05 $p=0.48$) |
| | SARS by COVID-19 | | SARS by Other etiologic agents and another virus |
| Source: SVS/MS | | | |

The comparison considering the sex factor, determined that the SARS by COVID-19 in relation to *Influenza A*nd, other viruses in the male sex is superior, respectively OR=1.23 (1.14-1.33, $p<0.0001$) and 22.72 (19.62-26.31, $p<0.0001$). On the other hand, females were proportionally higher for SARS, due to *Influenza A*nd other viruses, respectively OR=1.23 (1.14-1.33, $p<0.0001$) and other viruses with OR= 1.11 (1.04-1.18, $p=0.001$). The results for other age groups can be seen in Table 5, where segregation was performed using the grey scale, considering dark gray as a higher proportion of individuals who had SARS by COVID-19 top and light gray as a higher proportion of individuals who had SARS top by other etiologic agents and another virus. Considering the 219,212 death totals, due to SARS, 70.1% (153,621) were confirmed for COVID-19, 28.3% (61,997) were caused by no unspecified SARS; 1.1% (2,407) are under investigation; 0.1% (344) for *Influenza A* virus, 0.1% (260) for other respiratory viruses

**Table 6.** Deaths due notified SARS, according to final classification by epidemiological week 43.

| SARS | Absolute number | Percentage % |
|---|---|---|
| COVID-19 | 153,621 | 70.1 |
| *Influenza A* virus | 344 | 0.1 |
| Other respiratory viruses | 260 | 0.1 |
| Other etiologic agents | 583 | 0.3 |
| Not specified | 61,997 | 28.3 |
| Under investigation | 2,407 | 1.1 |

| TOTAL | 219,212 | 100 |
|---|---|---|
| Source: SVS/MS | | |

Among 153,621 deaths from SARS, due COVID-19 reported, patients had at least one comorbidity or risk factor for the disease. Heart disease and diabetes were the most frequent conditions and, the most of these individuals, who evolved to death and had some comorbidity, were 60 years old or older (Figure 3).

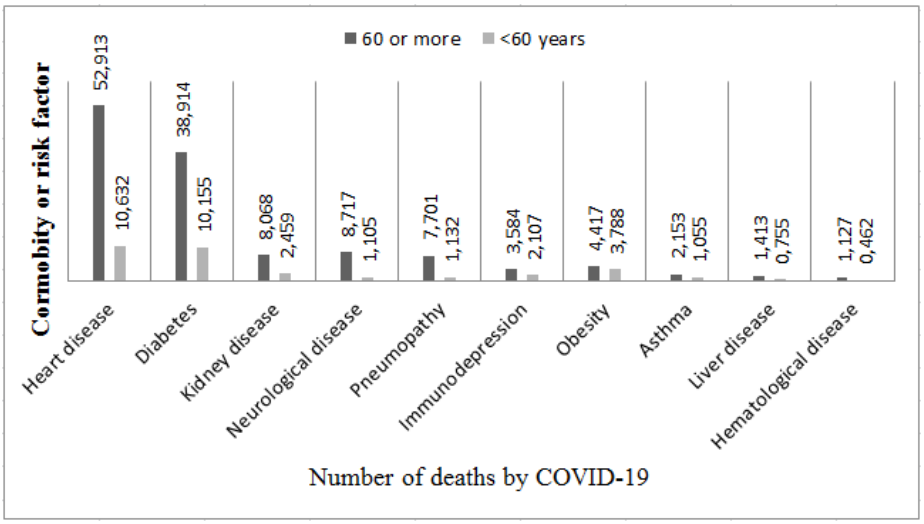


**Figure 3.** Comorbidities and risk factors for deaths from Severe Acute Respiratory Syndrome (SARS) by COVID-19 until epidemiological week 43.

## DISCUSSION

Coronavirus disease (COVID-19) is a highly pathogenic viral infection caused by SARS-CoV-2. Currently, COVID-19 has caused global health problems. The COVID-19 pandemic hit many countries with rapid general spread in society at and of February and began of March 2020, although there are indications that contagion was present in some individuals at December 2019, in an unknown way [18].

The high transmissibility of the virus determines the rapid spread mainly among asymptomatic or minimally symptomatic carriers, as well as the lack of immunity of cross protection from related viral infections and, also the lack of agility of the public power to take measures in public health [19].

According to the Pan American Health Organization (PAHO) [20], the region of the Americas was responsible for 64% of new deaths reported globally, totaling more than 213,000 new deaths, although it represents only 13% of the total population, with the majority of new deaths worldwide were reported by Brazil, with 19%, United States of America, with 16%; India, with 13% and, Mexico with 12%. Worldwide, the number of cases increased by 158% and 72% in the number of deaths. Same results were shown on Table 1 of this work.

However, daily case reports in the United States of America and Brazil show a certain drop. In Central America, cases and deaths have increased by more than 300% since June (cases increased from 61,058 to 266,000 and deaths increased from 1,580 to 7,203). South America has recorded more than 5.6 million cases and 186,000 deaths, almost three times the number of cases and twice as many deaths since last June.

In Brazil, after the identification of the first case, the spread grew day after day, in higher numbers. The number peak of confirmed cases and deaths occurred at EW 30, as shown in Figure 3. This number was lower than only the cases that occurred in the United States of America that had the highest number of accumulated cases. On the official website of the World Health Organization, in the Americas, the biggest peak occurred in EW 31 and corroborates with the most intense phase of the spread of the pathogen in all countries of the Americas [20,21].

The results indicate that the spread of the new coronavirus has a fractal character, as well as many other variables that describe social life. This means that contamination occurs discontinuously but exhibits the same pattern at different scales. An infected individual transmits to a relatively small group, with whom he maintains direct contact. Then there is a propagation gap, followed by a new stage that a small group, initially contaminated, began to contaminate a larger group [22].

To block contamination at the very beginning of the COVID-19 pandemic, many countries have determined lockdown and strict social distance measures to stop the spread of the coronavirus. As the number of cases decreased and the blocks were eliminated, people started to socialize again, and right now Europe is suffering from the second wave of contamination. This new wave is due the virulence of the virus, the opening of trade due to pressure from the economy and, the fact that people do not fully respect the virulence of the virus and, ignore the need for social distance [23].

Although, the Southeast region of Brazil, has a higher population density, the highest coefficients of incidence (2,235.0 cases/100 thousand inhabitants), occurred on Northeast region, during the EW 31 and, mortality (64.6 deaths/100 thousand inhabitants). This event is justified by the fact of the population from Northeast region, did not adhere to total social isolation, as determined by the surveillance agencies [24]. Mortality rates during the pandemic range began with 0.6% to 7.2% by region and, were substantially higher than the 0.1% mortality rate from seasonal influenza.

Patients with advanced age (>60 years) and, with severe pre-existing diseases, are more likely developing acute respiratory distress syndrome and die. Multiple organ failure has also been found in some cases of COVID-19 [5,25]. These arguments presented by these groups of researchers corroborate with the data of this work, described in Table4.

Huang and Mehta show in yours papers that the SARS-CoV-2 infection in humans, begins with mild symptoms and can progress to severe respiratory failure. The virus binds to the epithelial cells in the respiratory tract, begins to replicate and migrate into the airways and enters the alveolar epithelial cells in the lungs. Its rapid replication in the lungs can generate a strong immune response, producing a cytokine storm that causes acute respiratory distress syndrome (SARS) and respiratory failure, which is considered the leading cause of death in patients with COVID-19.

In addition to severe acute respiratory syndrome due to pulmonary and systemic inflammation, multiple organ dysfunction also occurs in high-risk patients. Sepsis, acute cardiac injury, and heart failure were the most common critical complications during COVID-19 exacerbation [26,27].

For Wu McGoogam, Lu and Guan, the clinical manifestations vary with age, and generally older men (>60 years of age) with comorbidities are more likely to develop severe respiratory illnesses that require hospitalization or progress to death, while most young people and children have mild symptoms (without pneumonia or mild pneumonia) or are asymptomatic.

Chen described that men over 68 years old had a higher risk of respiratory failure, acute heart injury and heart failure that led to death, regardless of history of cardiovascular disease, but among the complications presented as acute heart injury (77%), or death from heart failure (50%), patients had a history of hypertension or cardiovascular disease. According with dates show in this work, on Figure 3 [27-33].

## CONCLUSION

Brazil is a developing country, with a large territorial area, bordering several countries and, these characteristics may have been decisive in the evolution and control of the pandemic by COVID-19. Each state in the country has its local, social and demographic characteristics that used different strategies in response to the epidemic, since we have many inequalities in terms of social and portability to health services. Brazil has so far reduced its cases of COVID-19, demonstrating that the acute phase of the pandemic is diluting, Brazilian society has managed to live with the disease and the health crisis that has being overcome.

The medical equip is learning like treat the virus and, all population are waiting for the vaccine, as in many other countries, if the vaccination is positive and the transmission of the virus is controlled, a new survey of the data will be necessary for a more robust comparison with other studies, for help determining if Brazil has presented any facts different with other countries.

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