







Profile and spatial distribution of COVID-19 deaths in the municipality of Rio Grande/RS in 2020

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ABSTRACT

Objective: Describe the COVID-19 death profile in the city of Rio Grande, Rio Grande do Sul, Brazil.

Methods: This is a cross-sectional descriptive study using data from the Epidemiological Surveillance service deaths database of deaths notified from March to December 2020. **Results:** Of the 194 deaths, most were male (63.4%), aged 60 years or more (82.5%), of white skin color (82.5%), and living in the central historic district of the city (11.3%). With regard to occupation, the highest occurrence of deaths was among retirees (69.5%), followed by tradesmen or the self-employed (17.7%). Regarding morbidities, 38.7% had heart disease, 29.4% hypertension, 28.0% diabetes mellitus, and practically half of the individuals had multiple morbidities (49.0%). **Conclusions:** We identified the profile of COVID-19 deaths in the city of Rio Grande in the period from March to December 2020. These data can help health service managers to plan strategic and educational actions to prevent and combat COVID-19, mainly by targeting priority groups in vaccination campaigns.

Keywords: Mortality, Coronavirus infection, Age groups, Distribution by sex.

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INTRODUCTION

COVID-19 is an acute, viral respiratory disease, transmitted mainly by respiratory droplets with high transmissibility. Due to these characteristics and the absence of effective treatment, currently, the most effective way to reduce the spread of the virus is to isolate cases and achieve social distancing among the population¹.

Since March 2020, the COVID-19 pandemic has been plaguing Brazil, and one year later, the country became the global epicenter of the disease, accounting for 15 million confirmed cases and approximately 430,000 deaths. In turn, in May 2021, Rio Grande do Sul (RS) reached one million confirmed cases and 26,000 deaths, ranking 3rd in the number of deaths in Brazil, coming only behind the states of São Paulo and Minas Gerais. As for the municipality of Rio Grande/RS, in May 2021, it was in 12th place in the state in terms of cases, accounting for 14,883 confirmed cases and 399 deaths².

The COVID-19 mortality rate worldwide was approximately 201 per 100,000 inhabitants, while in Brazil as a whole, it was 200, in Rio Grande do Sul it was 232, and in Rio Grande, it was 189. Research reveals that mortality is higher among older men, males, and those with comorbidities³. However, most studies have evaluated the profile of deaths over a short period of time, without detailing work characteristics and comorbidities³.

The Port of Rio Grande is the city's main economic activity. It is also close to the border with Uruguay. These are characteristics that bring a large flow of people to the municipality⁴, hence the relevance of carrying out the study in this city. As such, the objective of this study was to identify the profile of COVID-19 deaths in the city of Rio Grande, Rio Grande do Sul, Brazil, with emphasis on detailing sociodemographic characteristics and morbidities, as well as spatial distribution in the municipality, with the aim of developing strategies for prioritizing care and immunization for the population with the poorest prognosis.

METHODS

This is a cross-sectional, descriptive study with secondary data from COVID-19 case notifications

made available by the Epidemiological Surveillance Information System of the city of Rio Grande, in the state of Rio Grande do Sul, Brazil. Rio Grande is a coastal city located in the southern region of Rio Grande do Sul (RS) and has a population of approximately 210,000 inhabitants and a population density of 72.79 inhabitants/km². The city is divided into fifty-four neighborhoods.

All cases of confirmed COVID-19 deaths between March and December 2020, whose current address was within the city of Rio Grande/RS, were included in the study. Confirmed COVID-19 cases were considered to be individuals with a positive laboratory test result for SARS-CoV-2, duly registered by the Health Surveillance service of the municipality of Rio Grande/RS. Individuals whose notification form did not present complete case data were excluded.

The variables investigated were: sex (female, male); age group (in years: 0-18 years; 19-59 years or 60 years or more); skin color (white, black/brown); type of diagnostic test (RT-PCR, rapid test, clinical imaging), profession (retired, commerce/self-employed, housewife/student/no occupation), neighborhoods of Rio Grande, presence or absence of morbidities: hypertension (yes/no), stroke (yes/no), diabetes mellitus (yes/no), heart disease (yes/no), chronic respiratory disease (yes/no), immunosuppressive disease (yes/no), chronic kidney disease (yes/no), chronic neurological disease (yes/no), obesity (yes/no), and multimorbidity (0 or 1/2 or more).

The data were tabulated using Excel version 16.0 and later analyzed using the Stata 16.1 statistical package (StataCorp/College Station, United States), and the results were extracted using descriptive statistics through the preparation of tables and graphs. The absolute and relative frequencies of the outcome were calculated according to the covariates. The distribution of deaths was also analyzed considering the epidemiological weeks, which are an international consensus to portray the conditions of the worsening of a given disease.

The present study was approved by the ethics committee of the Federal University of Rio Grande (FURG) as per Opinion No. 4.375.6, Certificate of Submission for Ethical Appraisal No. 39081120.0.0000.5324. The study was also submitted to and authorized by the Government of Rio Grande City, as per Opinion 029/2020.

RESULTS

In the period analyzed, 194 deaths were identified, of which 63.4% (95%CI 56.4; 70.0) (n=123) were male and 82.5% (95%CI 76.4; 87.2) (n=160) were of white skin color. The age group most frequently affected was 60 years or older, accounting for 82.5% (95%CI 76.4; 87.2). The most used type of diagnostic test was RT-PCR, accounting for 91.2% (95%CI 86.3; 94.5). The frequency of deaths was higher in retired individuals, who accounted for 69.5% (95%CI 62.5; 75.7) of cases (Table 1).

Regarding morbidities, 29.4% (95%CI 23.3; 36.2) had hypertension, 28.0% (95%CI 22.1; 34.8) had diabetes mellitus, 38.7% (95%CI 32, 0; 45.7) had heart disease, 13.4% (95%CI 9.2;19.0) had chronic respiratory disease, 10.3% (95%CI 6.7; 15.5) had immunosuppressive disease, 6.7% (95%CI 3.9; 11.2) had chronic kidney disease, 10.3% (95%CI 6.7;15.5) had chronic neurological disease, and 7.2% (95%CI 4.3; 11.9) were obese. As for multimorbidity, 49.0% (95%CI 42.0; 56.0) of the individuals had two or more chronic diseases (Table 1).

Figure 1 shows the distribution of deaths by epidemiological week. There was a significant increase in the number of deaths between weeks 27 to 33, accounting for 100 new deaths, and in weeks 49 to 53, accounting for 36 new deaths.

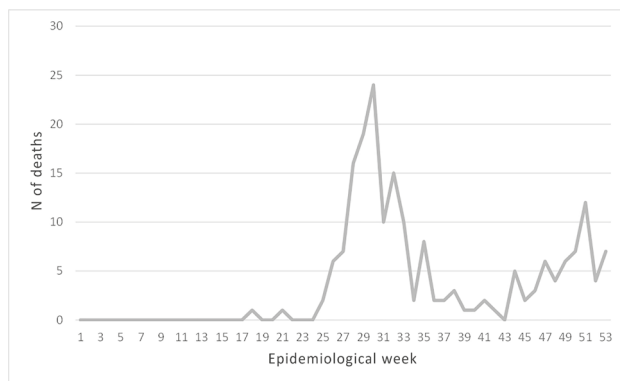


Figure 1. shows the distribution of deaths by epidemiological week. There was a significant increase in the number of deaths between weeks 27 to 33, accounting for 100 new deaths, and in weeks 49 to 53, accounting for 36 new deaths.

Figure 2 shows the spatial distribution of deaths by neighborhood, indicating that the highest frequency of deaths occurred in individuals from the Centro (historical) (11.3%), Cidade Nova (9.8%), São Miguel (7.7 %), Cassino (7.7%), Parque Marinha (4.6%), and Junção (4.6%) neighborhoods.

Table 1. Description of the profile of COVID-19 deaths in the municipality of Rio Grande, Rio Grande do Sul, Brazil, 2020 (n=194).

Variables	N	% (95%CI)
Gender		
Male	123	63.4 (56.4; 70.0)
Female	71	36.6 (30.1; 43.6)
Age		
0-18 years	01	0.5 (0.07; 3.6)
19-59 years	33	17.0 (12.3; 23.0)
60 years or more	160	82.5 (76.4; 87.2)
Skin Color		
White	160	82.5 (76.4; 87.2)
Black/Brown	34	17.5 (2.8;23.6)
Diagnostic test type		
RT-PCR	177	91.2 (86.3; 94.5)
Rapid Test	11	5.7 (3.2; 10.0)
Clinical Imaging	06	3.1 (1.4; 6.7)
Profession		
Retirees	130	69.5 (62.5; 75.7)
Self-employed	33	17.7 (12.8; 23.8)
Student/No occupation	24	12.8 (8.7; 18.5)
Morbidities		
Hypertension		
No	137	70.6 (63.8; 76.6)
Yes	57	29.4 (23.3;36.2)
Stoke		
No	191	98.5 (95.2; 99.5)
Yes	3	1.5 (0.4; 4.7)
Diabetes mellitus		
No	139	72.0 (65.2; 77.9)
Sim	54	28.0 (22.1; 34.8)
Congenital heart defects		
No	119	61.3 (54.3; 68.0)
Yes	75	38.7 (32.0; 45.7)
Chronic respiratory disease		
No	168	86.6 (81.0; 90.7)
Yes	26	13.4 (9.2;19.0)
Immunosuppressive disease		
No	174	89.7 (84.5; 93.2)
Yes	20	10.3 (6.7; 15.5)
Chronic kidney disease		
No	181	93.3 (88.8; 96.1)
Yes	13	6.7 (3.9; 11.2)
Chronic neurological disease		
No	174	89.7 (84.5; 93.3)
Yes	20	10.3 (6.7;15.5)
Obesity		
No	180	92.8 (88.1; 95.7)
Yes	14	7.2 (4.3; 11.9)
Multimorbidity		
0-1	99	51.0 (44.0; 58.0)
2 or more	95	49.0 (42.0; 56.0)

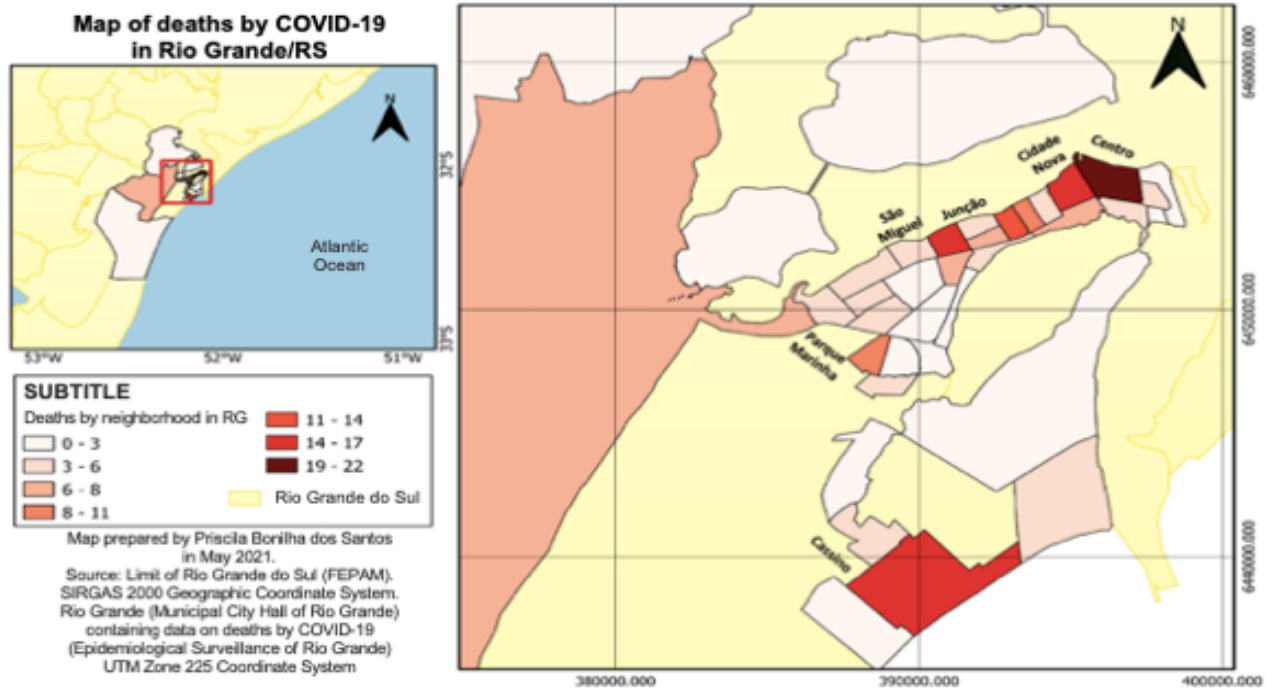


Figure 2. shows the spatial distribution of deaths by neighborhood, indicating that the highest frequency of deaths occurred in individuals from the Centro (historical) (11.3%), Cidade Nova (9.8%), São Miguel (7.7%), Cassino (7.7%), Parque Marinha (4.6%), and Junção (4.6%) neighborhoods.

DISCUSSION

The findings of this study reveal the occurrence of deaths about twice as high in males, mostly among the elderly and those of white skin color. We also found that most were retired, lived in the historic central district of the city, and were diagnosed using the RT-PCR test. The most prevalent morbidities were heart disease, followed by hypertension and diabetes, while half of the individuals who died due to COVID-19 had multiple morbidities.

In Brazil, the COVID-19 mortality rate was 194.0 deaths per 100,000 inhabitants, while in Rio Grande do Sul, it was 220.7, evidencing a higher rate than the national rate. Among the cities in Rio Grande do Sul, Rio Grande also had a death rate higher than the overall Brazilian rate, with approximately 202.4 per 100,000 inhabitants, which placed it in the eleventh place regarding COVID-19 deaths among the state's cities⁵.

In this investigation, the frequency of deaths was higher among male and elderly patients, similar to other studies in the international literature⁶⁻⁹.

Male individuals are more susceptible to infections caused by viruses, bacteria, and parasites due to poorer lifestyle habits. In addition, men also tend to seek health services less, and when they do, usually the outcomes are already at their more severe stages, reducing the chance of a good prognosis, these being behavioral characteristics that may explain the higher occurrence of deaths among males¹⁰⁻¹².

Regarding age, it is suggested that older people are more vulnerable due to morbidities such as hypertension, diabetes, and cardiovascular diseases¹³, which can worsen the prognosis or lead to death³. Regarding the immune system, another important factor is the decline of this system with aging, presenting difficulty in recognizing pathogens, warning and releasing signs, in addition to a chronic increase in inflammation¹⁴. A study by Mueller et al. (2020) demonstrates that these factors drive high mortality rates in this population¹⁵.

The study results also showed a higher occurrence of deaths in White individuals, but some data show that Black individuals have a higher case fatality ratio, with divergences in the literature¹⁶.

There are no hypotheses for this finding, but these results may be due to underreporting data on race and skin color^{17,18}.

The higher prevalence of deaths among retirees converges with age-related results and reinforces the importance of social distancing policies for this portion of the population due to the high risk of presenting complications due to COVID-19 and preserving health systems from chaos due to demand exceeding supply, especially concerning ICU beds^{18,19}.

However, it is noteworthy that about 20% of the deaths occurred in commerce workers or the self-employed, who usually have greater difficulty in isolation, quarantine, and social distancing, increasing their vulnerability to the virus due to the need to maintain their financial income²⁰.

This finding reinforces the importance of state action through income distribution strategies in order to increase the population's income, seeking to minimize social inequalities^{21,22}. It should be noted that in Brazil, 150 million people requested emergency aid (a benefit to guarantee a minimum income for Brazilians in vulnerable situations during the pandemic - Law No. 13982/2020), and 50.5 million people were considered eligible, which shows a significant portion of the population surviving in conditions of poverty, mainly due to the COVID-19 pandemic²³.

In our study, we found that the highest number of COVID-19 deaths occurred from the 27th to 33rd and from the 49th to 53rd weeks of controlled distancing when the state of Rio Grande do Sul was at risk. However, according to the co-management system, Rio Grande, which belongs to the Pelotas region of the state, was at medium risk for COVID-19 infection. This classification allowed for greater flexibility with the opening of commerce, restaurants, and public places, which inevitably causes crowding. This finding reinforces the direct relationship between the reduction of restriction measures, the increase in disease outbreaks, and the consequent higher number of deaths²⁴.

As for morbidities, the study carried out by Rottoli et al. (2020) is in line with the findings of our research, in which they point to hypertension, cardiovascular diseases, diabetes, obesity, and chronic obstructive pulmonary disease as the

diseases strongly related to a greater risk of worsening and deaths of patients infected by COVID-19^{25,26}. In turn, the effect of multimorbidity on the occurrence of COVID 19 deaths stands out, corroborating the findings of Nunes et al. (2020), who reiterated that the increased risk of infection by COVID-19 among people with multimorbidity may be associated with an increase in inflammation and decrease in the body's immune response capacity²⁷. Epidemiological evidence on the greater severity of the novel coronavirus among people with multimorbidity has led people with such diagnoses to be covered by the National Immunization Plan²⁸. Taking into account the amount defined as to the availability of vaccines to be provided to the target population, there has been an assertive prioritization of groups with morbidities, as they demonstrate a greater risk of exposure, complications, and death due to COVID-19²⁸.

Regarding the distribution of deaths, the highest occurrence was concentrated in the historic central district of the city. However, it is known that in peripheral regions, there are a greater number of people in situations of vulnerability, but our results show that the highest prevalence of deaths was, in fact, in downtown neighborhoods, which contain a greater number of census tracts with more residents per square meter, emphasizing that social distancing is one of the most important prerogatives for reducing the circulation of the virus, and reducing the occurrence of death, as shown by some Brazilian studies^{20,29}. In addition, more elderly individuals, who are at greater risk of death due to COVID-19, usually reside in these neighborhoods, which may explain our findings²⁷.

However, the material found in this study must be interpreted considering its limitations and strengths. First, the use of secondary data depends on the quality of the records of the reporting units and may have missing or incomplete data. As for the strengths, it should be noted that all information on deaths is robust, and notification errors rarely occur. In addition, our study has important clinical applicability, providing unpublished data from the region, which can help local health managers in organizing prevention and care measures for patients with COVID-19.

CONCLUSION

In this study, the highest occurrence of deaths was found in individuals over 60 years of age, male, white, with hypertension and diabetes mellitus, and who were retired. In addition, the period in which death records were highest occurred at a time when cities in the state of Rio Grande do Sul adopted less restrictive social distancing measures. Thus, we understand that measures to control the spread of the disease are related to the likelihood of death. Therefore, it is essential that state and municipal agencies and society have greater knowledge of the risks in order to take effective measures on actions to restrict circulation, allocation of human resources and supplies, expansion of the health care network, and pay attention to vulnerable populations with a view to reduce harm and preserve the population's health. Finally, the findings of this study can be used to assist health service managers in planning strategic and educational prevention actions, such as the use of adequate sanitary measures and, specifically, vaccination campaign targeting, as these actions will contribute to reducing COVID-19 cases and deaths.

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Author Contributions

VIEIRA, Y.P. contributed to the study design and data interpretation, drafting the preliminary version and reviewing and approving the final version; SOARES JUNIOR, A.O. contributed to the study design, data interpretation, drafting the preliminary version and reviewing and approving the final version, NUNES, L.S. participated in drafting the preliminary version, AFONSO, M.S. took part in drafting the preliminary version, DURO S.M.S. contributed to the study design, data interpretation, reviewing and approving the final version, SAES M.O. contributed to the study design, data interpretation, reviewing and approving the final version.

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