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Weighted analysis of epidemiological outcomes in patients with COVID-19: a cross-sectional observational study

Análise ponderada dos desfechos epidemiológicos em pacientes com COVID-19: um estudo observacional transversal

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Abstract
The COVID-19 pandemic prompted emergency responses from governments and health agencies worldwide, implementing public policies that reduced mortality among affected patients. However, during the public health emergency, the low regionalization of care programs significantly reduced the effectiveness of preventive measures. This study investigated the relationship between vaccination status, sociodemographic factors, comorbidities, and symptoms with COVID-19 outcomes in 6,953 patients treated at screening centers in São Gonçalo, Rio de Janeiro, Brazil. Data collection occurred between July and December 2021, including sociodemographic information, vaccination history, presence of comorbidities, symptoms, and COVID-19 test results. The sample predominantly consisted of mixed-race individuals (51%), with 61% being women and 60% aged between 21 and 50 years. The most prevalent comorbidities were hypertension (18.2%), diabetes (4.9%), and obesity (0.4%). Young individuals (11–30 years) and White participants were more represented among the positive tests, with White individuals accounting for 40.1% of all positive results. Hypertension was associated with higher odds of testing positive (OR = 1.54; 95% CI: 1.28–1.83; p-value < 0.001), whereas obesity was associated with lower odds of positivity (OR = 0.13; 95% CI: 0.02–0.63; p-value = 0.025). This study identified a higher rate of positive results among young (11–30 years) White and hypertensive individuals. Symptoms such as fever, loss of smell, and loss of taste were the primary indicators of infection (OR > 2.00; p-value < 0.001). The regionalized characterization of COVID-19 patients will inform further research and policies to mitigate harm in public health emergencies.
Keywords: SARS-CoV-2. COVID-19 Testing. Pandemics. COVID-19 Vaccines.

Resumo
A pandemia da COVID-19 provocou reações emergenciais por parte de governos e órgãos de saúde em todo o mundo, com políticas públicas que reduziram a mortalidade dos pacientes afetados. Ao longo do período de emergência em saúde, porém, a baixa regionalidade dos programas de atenção reduziu, substancialmente, a eficácia das medidas preventivas. Dessa forma, o presente estudo investigou a relação entre status vacinal, fatores sociodemográficos, comorbidades e sintomas com os desfechos da COVID-19 em 6.953 pacientes atendidos em centros de triagem de São Gonçalo, Rio de Janeiro, Brasil. Os atendimentos ocorreram entre julho e dezembro de 2021, onde foram coletadas informações sociodemográficas, histórico vacinal, presença de comorbidades, sintomas e resultados de testes para COVID-19. A amostra foi composta majoritariamente por indivíduos pardos (51%), com 61% de mulheres e 60% entre 21 e 50 anos. As comorbidades mais prevalentes foram hipertensão (18,2%), diabetes (4,9%) e obesidade (0,4%). Indivíduos jovens (11–30 anos) e participantes brancos estiveram mais representados entre os testes positivos, sendo que pessoas brancas corresponderam a 40,1% de todos os resultados positivos. A hipertensão esteve associada a maiores chances de um teste positivo (OR = 1,54; IC 95%: 1,28–1,83; p-valor < 0,001), enquanto a obesidade mostrou associação com menores chances de positividade (OR = 0,13; IC 95%: 0,02–0,63; p-valor = 0,025). O presente estudo identificou maior taxa de resultados positivos entre jovens (11-30 anos) brancos e hipertensos. Sintomas como febre, perda de olfato e paladar foram os principais indicadores de infecção (OR > 2,00; p-valor < 0,001). A caracterização regionalizada dos pacientes COVID-19 informará pesquisas adicionais e políticas na prevenção de danos em emergências de saúde pública.
Palavras-chave: SARS-CoV-2. Teste Para COVID-19. Pandemias. Vacinas Contra COVID-19.

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Introduction

SARS-CoV-2, or severe acute respiratory syndrome coronavirus 2, a virus of the family *Coronaviridae*, genus *Betacoronavirus* and subgenus *Sarbecovirus*, is the causative agent of coronavirus disease 2019 (COVID-19). This enveloped, approximately spherical virus has a diameter of about 60–140 nm and a positive-sense single-stranded RNA genome of about 30,000 nucleotides[1]. Its high transmissibility occurs through respiratory droplets and contact with contaminated surfaces[2].

The initial outbreak in Wuhan, China, at the end of 2019 led to the global COVID-19 pandemic[3], which became a major public health challenge. By 2023, more than 760 million cases and 6.8 million deaths had been reported[4]. The virus primarily affects the respiratory system, with symptoms ranging from mild to severe, including fever, cough, shortness of breath, fatigue, pneumonia, multiple organ failure, and death[5].

As the main control strategy, global efforts to develop vaccines resulted in immunizing agents capable of preventing infections and reducing disease severity. However, the pandemic caused delays in vaccination schedules, especially in children, highlighting the importance of maintaining continuous vaccination to contain the spread of the virus[6].

Large-scale global studies enabled the implementation of rapid public policies with effectiveness compatible with the emergency context of the pandemic[7]. On the other hand, the analysis of pandemic outcomes at a more granular geographic level is crucial to ensure the implementation of more effective public policies in future health emergencies.

In this context, this study analyzes data from 6,953 individuals seen at screening centers in the municipality of São Gonçalo, Rio de Janeiro, Brazil. The aim was to investigate how sociodemographic factors, comorbidities, and symptoms influence COVID-19 test results, with a focus on the most prevalent characteristics, such as hypertension, and the most frequent symptoms, including fever and sensory changes.

Materials and Methods

Study design

The design of this study is observational, cross-sectional, and analytical. The study sample, collected by convenience, consists of data from patients who sought care at screening centers in São Gonçalo, a municipality in the state of Rio de Janeiro, Brazil, between July 28, 2021, and December 2, 2021. The study variables of interest were sociodemographic characteristics, vaccination data, and self-reported symptoms/comorbidities at the time of data collection.

According to the Brazilian Institute of Geography and Statistics, São Gonçalo covers a territorial area of 248.160 km². In 2022, the resident population was estimated at 896,744 people, resulting in a population density of 3,613.57 inhabitants per km². The school enrollment rate for children aged 6 to 14 years was 96.7% in 2010, and the Municipal Human Development Index was 0.739. Economically, the gross domestic product per capita was R$ 18,504.81 in 2021. Infant mortality, a critical health indicator, was 12.33 deaths per 1,000 live births in 2020[8].

Inclusion criteria and informed consent

Patients included in the study presented clinical symptoms suggestive of SARS-CoV-2 infection and underwent COVID-19 testing using the RT-LAMP technique. The screening centers in São Gonçalo served as sites for data collection and sample analysis. This study followed the ethical principles outlined in the

Declaration of Helsinki and applicable Brazilian legislation. Strict measures were implemented to ensure patient confidentiality, with all data anonymized prior to analysis.

The research protocol was reviewed and approved by the Research Ethics Committee of Universidade do Grande Rio under protocol number 32362220.1.0000.5283. All participants were thoroughly informed about the objectives and potential risks of the study and provided written informed consent to participate. Participation was voluntary, without coercion or undue pressure, and participants had the right to withdraw their consent at any time without facing any adverse consequences. The study was conducted in accordance with the highest ethical standards, ensuring the integrity and dignity of both participants and researchers.

Data collection

Data collection at the screening centers in São Gonçalo, Rio de Janeiro, included sociodemographic characteristics, comorbidities, COVID-19 symptoms, vaccination history, and COVID-19 test results. Patient age was determined by recording the date of birth and the date of sample collection. Race/skin color was documented to capture ethnic diversity. Comorbidities such as hypertension, diabetes, and obesity were recorded in detail, along with other associated conditions.

The date of onset of COVID-19 symptoms and the specific symptoms reported, such as runny nose, fever, loss of smell and taste, diarrhea, headache, shortness of breath, muscle pain, and cough, were documented. COVID-19 test results using the RT-LAMP technique were classified as positive or negative. The number of vaccine doses received, the type of vaccine administered, and the date of administration were also recorded.

Health professionals, following safety and ethical protocols, conducted data collection. Participants were informed about the purpose of data collection and provided written informed consent. Data confidentiality was maintained, and all information was handled anonymously.

Statistical analysis

The statistical analysis of this study was performed using RStudio (version 2023.06.1 + 524) with the R programming language (version 4.2.2).

Univariate analysis was used to describe the profile of participants, identify the number of nonresponses, and detect outliers. The data presented in Table 1 and in Supplementary Tables 1 and 2 include the analysis of sociodemographic characteristics, comorbidities, COVID-19 test results, and other relevant variables. This analysis was conducted using absolute and relative frequencies.

Bivariate analysis was performed to examine significant associations between the study variables. Considering that the data were collected from a convenience sample, weights were calculated by post-stratification based on the known population distributions of race/skin color and sex[8]. Subsequently, Pearson's chi-square (χ^2) test with Rao & Scott adjustment was used to evaluate the associations between the study variables:

$$\chi^2{}_{\omega} = \frac{\left(\sum \frac{(O_{ij} - E_{ij})^2}{E_{ij}}\right)}{D_{ef}}$$

Where $\chi^2\omega$ represents the chi-square test statistic adjusted for weighting, *Oij* denotes the observed frequencies, *Eij* refers to the expected frequencies, and Def is the design effect. This methodological approach is consistent with the literature on statistical data analysis in the health field, as highlighted by Cleophas & Zwinderman[9], who emphasize the importance of univariate and bivariate analyses, as well as the use of Pearson's chi-square test for assessing associations between categorical variables. Furthermore, to evaluate the strength of the associations identified by the χ^2 test, the weighted Cramér's V index was calculated:

$$V_\omega = \sqrt{\frac{\chi^2{}_\omega}{N_\omega \times \min(r-1, c-1)}}$$

Where $V\omega$ indicates the strength of the association between the variables (Cramér's V index), $\chi^2\omega$ is the weighted chi-square test statistic, $N\omega$ is the total weight (sum of all weights), r is the number of rows in the contingency table, and c is the number of columns in the contingency table. For interpretative purposes, $\chi^2\omega$ and $V\omega$ values with p-values less than 0.05 were considered statistically significant, allowing rejection of the null hypothesis.

Finally, to analyze the relationship between the various study variables, odds ratios (OR) were calculated, providing a measure of the association between exposure variables and the outcome, which in this case is the COVID-19 test result. The OR were obtained from a logistic regression model estimated by maximizing the log-likelihood:

$$L(\beta) = \sum_{i=1}^{n} \omega_i [y_i \log(p_i) + (1 - y_i) \log(1 - p_i)]$$

$$OR = e^{\beta j}$$

Where $L(\beta)$ is the log-likelihood function, pi is the predicted probability that $Yi = 1$, OR is the weighted odds ratio for a given predictor, and βj is the estimated coefficient for the predictor. For each OR calculated, a 95% confidence interval (95% CI) was also computed to assess the precision of the estimate. In addition, for interpretative purposes, p-values less than 0.05 were considered statistically significant. This approach ensures that the associations identified are less likely to occur by chance.

Results

Table 1 details the sociodemographic characteristics of the study participants, categorizing them by age group, race/skin color, and gender. Age groups ranged from 10 to 81 years or older. Race/skin color was classified as Brown (pardo), White, Black, Other, and Not reported. The data indicate that most participants were Brown (51%), followed by White (38%) and Black (9.5%). In addition, a substantial proportion of participants were female (61%). With respect to age, the largest group consisted of individuals between 21 and 50 years old, representing approximately 60% of the participants. Those between 61 and 80 years accounted for about 14%, while participants aged 81 years or older represented about 1% of the total sample.

Table 1. Sociodemographic characteristics of the cohort of participants (patients) seen at the screening centers in São Gonçalo (Rio de Janeiro), from 07/28/2021 to 12/02/2021.

Variables	**N = 6.953**[a]
AGE	
≤ 10 years	10 (0.1%)
11 - 20 years	491 (7.1%)
21 - 30 years	1.419 (20%)
31 - 40 years	1.406 (20%)
41 - 50 years	1.457 (21%)
51 - 60 years	1.142 (16%)
61 - 70 years	679 (9.8%)
71 - 80 years	274 (3.9%)
≥ 81 years	75 (1.1%)
RACE/SKIN COLOR	
Brown	3.490 (51%)
Caucasian	2.625 (38%)
Black	652 (9.5%)
Other	88 (1.3%)
Unavailable	98
SEX	
Female	4.263 (61%)
Male	2.690 (39%)

Note: a) Sample size, indicated as number and frequency (%).

Major comorbidities (i.e., obesity, hypertension, and type II diabetes) were also examined (Supplementary Table 1). Most participants reported not having diabetes (95.1%), obesity (99.6%), or hypertension (81.8%). Among the reported comorbidities, hypertension was the most prevalent (18.2%), followed by diabetes (4.9%) and obesity (0.4%). This highlights hypertension as the most common comorbidity within the study sample.

Supplementary Table 2 presents additional variables beyond comorbidities and sociodemographic characteristics of the study participants. It details the number of participants who reported symptoms such as fever, runny nose, loss of smell, loss of taste, diarrhea, headache, shortness of breath, and muscle pain. The table also provides information on participants' vaccination status, including the number of doses received and the type of vaccine administered.

The data indicate that most participants did not present fever above 38.5°C (73.4%), runny nose (65.6%), loss of smell (86%), or loss of taste (85.9%). Furthermore, most participants received two vaccine doses (62.5%), with the Oxford–AstraZeneca vaccine being the most administered (45%). Among the variables examined, headache was the most frequently reported symptom, affecting 49% of participants.

Table 2 describes the distribution of age, race/skin color, and gender among those who tested positive or negative for COVID-19. Within the positive group, individuals aged 11–20 years made up 7.4%

of cases, slightly higher than their share in the negative group, which was 6.8%. The same pattern appears in the 21–30-year group, which accounted for 18.0% of positives and 21.3% of negatives, and in the 31–40-year group, with 17.8% of positives and 21.1% of negatives. The proportion of positives becomes smaller in the older age ranges. In the 71–80-year group, 6.8% of all positive tests came from this age range, whereas they represented 2.8% of the negative results. Among individuals aged 81 years or older, 1.3% of positive results and 1.0% of negative results occurred in this group.

Table 2. Relationship between the sociodemographic profile and COVID-19 test results of the participants (patients) seen at the screening centers in São Gonçalo (Rio de Janeiro), from 07/28/2021 to 12/02/2021.

Variables	**TOTAL** N = 6.878[a]	**NEGATIVE** N = 4.925[a]	**POSITIVE** N = 1.953[a]	**p-value**[b]
AGE				< 0.001*
≤ 10 years	10 (0.1%)	6 (0.1%)	4 (0.2%)	
11 - 20 years	482 (7.0%)	337 (6.8%)	145 (7.4%)	
21 - 30 years	1.399 (20.3%)	1.048 (21.3%)	351 (18.0%)	
31 - 40 years	1.386 (20.2%)	1.039 (21.1%)	347 (17.8%)	
41 - 50 years	1.441 (21.0%)	1.063 (21.6%)	378 (19.4%)	
51 - 60 years	1.137 (16.5%)	796 (16.2%)	341 (17.5%)	
61 - 70 years	676 (9.8%)	448 (9.1%)	228 (11.7%)	
71 - 80 years	272 (4.0%)	139 (2.8%)	133 (6.8%)	
≥ 81 years	75 (1.1%)	49 (1.0%)	26 (1.3%)	
RACE/SKIN COLOR				0.002*
Brown	3.446 (50.8%)	2.490 (51.2%)	956 (49.9%)	
Caucasian	2.605 (38.4%)	1.836 (37.7%)	769 (40.1%)	
Black	646 (9.5%)	478 (9.8%)	168 (8.8%)	
Other	84 (1.2%)	61 (1.3%)	23 (1.2%)	
Unavailable	97	60	37	
SEX				0.394
Female	4.226 (61.4%)	3.096 (62.9%)	1.130 (57.9%)	
Male	2.652 (38.6%)	1.829 (37.1%)	823 (42.1%)	

Note: a) Sample size, indicated as number and frequency (%). Only 6,878 had definitive test results and were included in comparative analyses; b) p-value for Pearson's χ^2 test (unweighted). The superscript asterisk (*) indicates p-value < 0.05.

Race and skin color followed a similar pattern of uneven representation across test outcomes. Brown participants made up nearly half of the positive results, at 49.9%, a proportion slightly lower than their share among negatives, which reached 51.2%. White participants comprised 40.1% of the positive group and 37.7% of the negative group, while Black participants accounted for 8.8% of positives and 9.8% of negatives. The remaining categories showed almost no difference, with 1.2% of positives and 1.3% of negatives falling into the "other" group. A small fraction of individuals lacked race or skin-color classification, and this omission did not alter the overall pattern. Gender also displayed no meaningful divergence between outcomes. Women represented 57.9% of the positive tests and 62.9% of the negative tests, whereas men accounted for 42.1% of positives and 37.1% of negatives.

Table 3 illustrates the unweighted chi-square analysis of the relationship between comorbidities and COVID-19 test results. It details the number of participants who reported hypertension, diabetes, and obesity, as well as the number of participants who tested positive or negative for COVID-19 within each comorbidity group.

Table 3. Comorbidities and COVID-19 test results.

Variables	TOTAL N = 6.878[a]	NEGATIVE N = 4.925[a]	POSITIVE N = 1.953[a]	p-value[b]
HYPERTENSION				0.578
No	5.623 (81.8%)	4.026 (81.8%)	1.597 (81.9%)	
Yes	1.250 (18.2%)	896 (18.2%)	354 (18.1%)	
Unavailable	5	3	2	
DIABETES				0.230
No	6.529 (95.1%)	4.674 (95.0%)	1.855 (95.1%)	
Yes	339 (4.9%)	244 (5.0%)	95 (4.9%)	
Unavailable	10	7	3	
OBESITY				< 0.001*
No	6.825 (99.6%)	4.884 (99.5%)	1.941 (99.7%)	
Yes	29 (0.4%)	23 (0.5%)	6 (0.3%)	
Unavailable	24	18	6	

Note: a) Sample size, indicated as number and frequency (%). Only 6,878 had definitive test results and were included in comparative analyses; b) p-value for Pearson's χ^2 test (unweighted). The superscript asterisk (*) indicates p-value < 0.05.

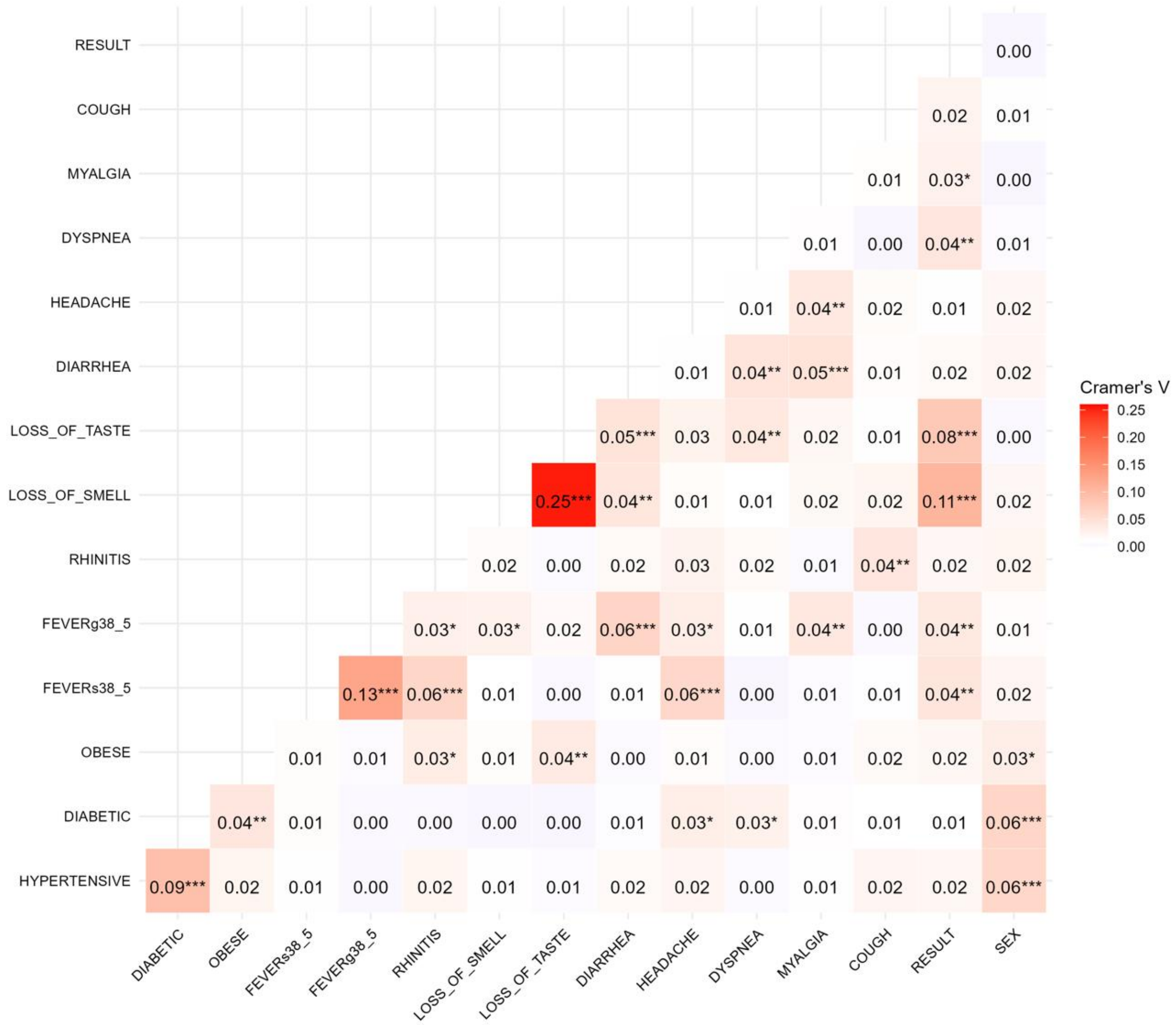
The analysis of comorbidities and their association with COVID-19 test results provides some important observations. Hypertension did not show a significant link with test results. Among those without hypertension, the proportion of positive tests was 81.9%, virtually identical to the proportion of negative tests (81.8%). Similarly, 18.1% of individuals with hypertension tested positive, compared with 18.2% who tested negative. Additionally, the data showed that 95.1% of individuals without diabetes tested positive, while 95.0% tested negative. Among those with diabetes, 4.9% tested positive compared with 5.0% who tested negative.

Supplementary Table 3 presents the relationship between symptoms, vaccination status, and COVID-19 test results. It categorizes participants according to the presence of fever (>38.5°C), runny nose, loss of smell, loss of taste, diarrhea, headache, shortness of breath, muscle pain, and cough, as well as vaccination status, comparing the number of positive and negative tests. A substantial proportion of positive cases had fever >38.5°C (15.8%), low-grade fever ≤38.5°C (34.9%), loss of smell (29.3%), and loss of taste (26.6%). Most negative cases did not present these symptoms. Dyspnea was more common in negative cases (13.1% versus 9.1%), whereas myalgia was more frequent in positive cases (37.4% versus 32.3%).

In the sample, receipt of at least one vaccine dose was associated with a lower rate of positive COVID-19 test results (p-value = 0.002). The data indicate that 1,569 (29.9%) individuals received the first dose, with approximately 67% of them testing negative. Among those who received the second dose, about 77% had a negative result. For those who received the third dose, the frequency of negative tests was about 70%. Recipients of a single-dose vaccine showed approximately 73% negative results. The type of vaccine was not significantly associated with test results (p-value = 0.572).

In addition to analyzing the independence of the study variables, the strength of the associations between variables of interest and parameters such as race/skin color, vaccination status, and the number of vaccine doses received was also assessed. As illustrated in Figure 1, loss of taste and loss of smell showed the highest (though weak) correlations with test results (Cramér's V = 0.08 and 0.11, p-value < 0.001). Low-grade fever and high fever (highly intercorrelated, V = 0.13), as well as dyspnea, showed similarly negligible (though significant) correlations with test results (Cramér's V = 0.04, p-value < 0.01). Finally, myalgia was the symptom with the lowest significant correlation with test results (Cramér's V = 0.03, p-value < 0.05).

Figure 1. Heat map of the magnitude of association (weighted Cramér's V) between the study variables.

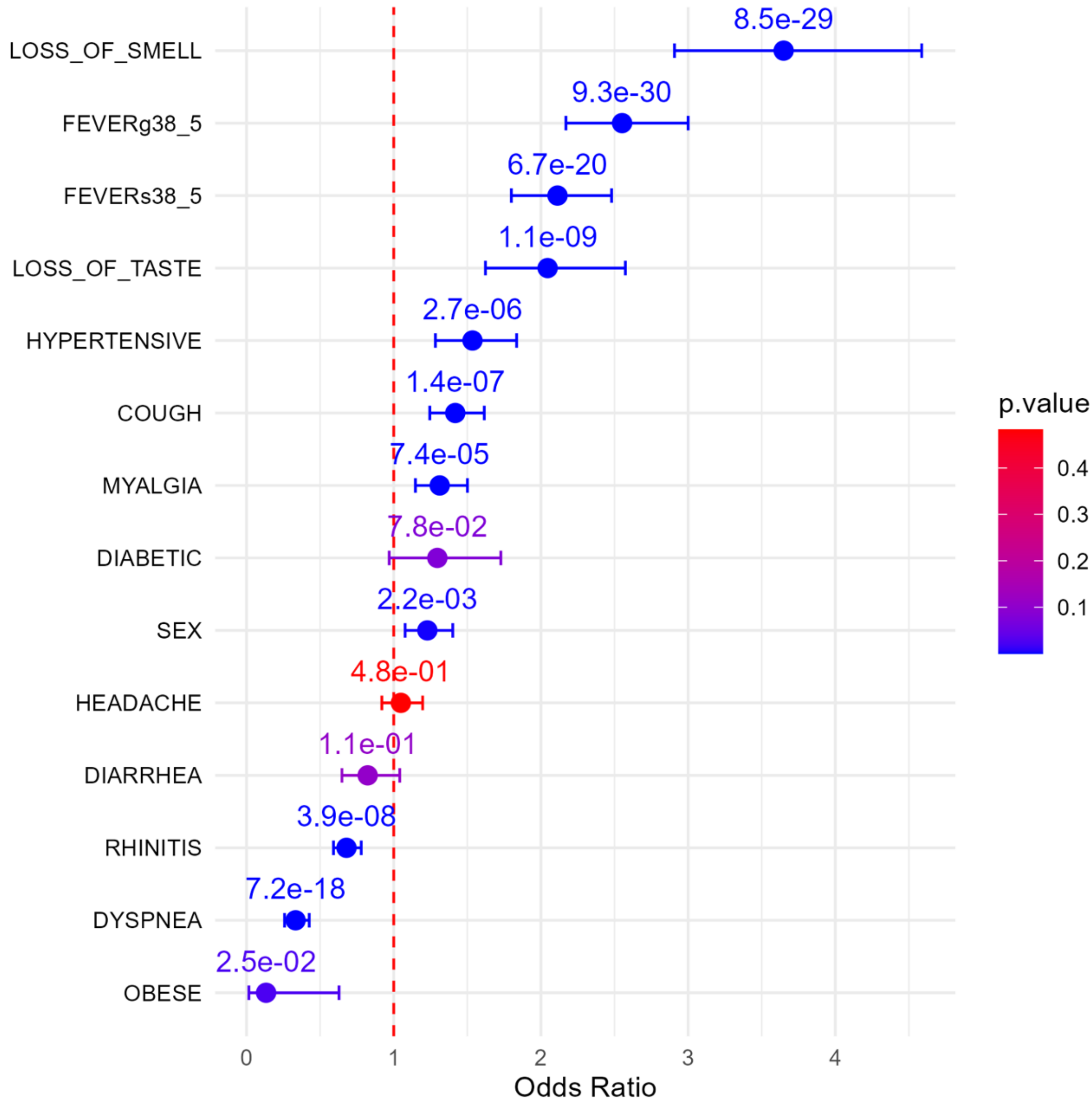


Note: Heat map representing the magnitude of association (Cramér's V) between the study variables; the values indicate the strength of the association, with darker shades representing stronger relationships; significant associations are indicated with asterisks: *p-value < 0.05, **p-value < 0.01, and ***p-value < 0.001.

We calculated weighted odds ratios for the study variables in relation to COVID-19 test outcomes, as summarized in Figure 2. Hypertension showed a clear association with testing positive, with an odds ratio of 1.54 (95% CI: 1.28–1.83; p < 0.001). Elevated temperature was also strongly linked to positivity. Fever above 38.5 °C corresponded to an odds ratio of 2.55 (95% CI: 2.17–3.00; p < 0.001), and even milder fever, at or below 38.5 °C, remained associated with increased odds of a positive result, with an odds ratio of 2.11 (95% CI: 1.80–2.48; $p < 0.001$).

Obese patients (OR = 0.13, 95% CI: 0.02–0.63; p-value = 0.025), those who presented rhinitis (OR = 0.68, 95% CI: 0.59–0.78; p-value < 0.001), and those with dyspnea (OR = 0.33, 95% CI: 0.26–0.43; p-value < 0.001) had lower odds of testing positive. On the other hand, loss of smell (OR = 3.65, 95% CI: 2.91–4.59; p-value < 0.001), loss of taste (OR = 2.05, 95% CI: 1.62–2.57; p-value < 0.001), myalgia (OR = 1.31, 95% CI: 1.15–1.50; p-value < 0.001), and cough (OR = 1.42, 95% CI: 1.25–1.62; p-value < 0.001) were strong indicators of positive test results.

Figure 2. Weighted odds ratios evaluating study variables in relation to COVID-19 test results.



Note: Forest plot of odds ratios (OR) for symptoms and comorbidities; the red dashed line (OR = 1) indicates no association; points to the right suggest increased risk, while points to the left suggest reduced risk; the colors represent p-values, with blue indicating a low value and red indicating a high value.

Discussion

Age, race/skin color, and gender significantly influence infection rates and COVID-19 outcomes. In the cohort analyzed, 74.5% of positive cases were older than 31 years, with the highest prevalence in the 41–50-year age group (19.4%), reflecting the impacts of aging, such as immunosenescence and inflammation[10]. Racial minorities were disproportionately affected, with 59.9% of positive cases identified as non-White (Brown, Black, and other race/skin color categories), reinforcing the influence of socioeconomic barriers and limited access to healthcare[11,12].

Women accounted for 57.9% of positive cases, which may be related to their greater representation in healthcare professions and to a more robust immune response associated with genetic factors, such as expression of the TLR7 gene on the X chromosome, which increases interferon production[13]. By contrast, men showed greater vulnerability to severe outcomes, including higher mortality rates[14].

Hypertension is one of the main risk factors for adverse COVID-19 outcomes, being associated with severe cases and higher mortality, with studies reporting up to 74% of deaths among hypertensive patients with moderate symptoms[15] and a significant increase in the risk of severe infection (OR 1.22; CI 1.12–1.33). However, the causal relationship between hypertension and infection remains uncertain, as some studies show similar prevalence between severe and mild cases[16].

Diabetes is also strongly associated with severe symptoms and higher mortality, worsened by complications such as peripheral neuropathy and vascular insufficiency, which nearly double the risk of death[17]. Obesity, in turn, not only reduces cardiorespiratory reserve but also exacerbates immune dysfunction, increasing the risk of mechanical ventilation (OR 2.17; CI 1.59–2.97) and mortality (OR 1.67; CI 1.39–2.00)[18]. In the present study, hypertension was the most prevalent comorbidity (18.2%), followed by diabetes (4.9%) and obesity (0.4%), with significant differences only in the frequency of obesity between positive and negative patients (χ^2 p-value < 0.001).

COVID-19 infection is associated with a wide range of symptoms, including fever, anosmia, ageusia, cough, fatigue, shortness of breath, myalgia, and gastrointestinal symptoms such as diarrhea and nonspecific abdominal pain[19]. Pulmonary complications include pneumonia and acute respiratory distress syndrome (ARDS), whereas extrapulmonary symptoms encompass arrhythmias and neurological manifestations[20]. Differential diagnosis is challenging due to symptom overlap with other respiratory diseases and influenza, requiring multidisciplinary approaches and specific tests such as SARS-CoV-2 antigen detection[21].

In the present study, the most prevalent symptoms among positive patients were fever (high ≥ 38.5°C, 15.8%; low < 38.5°C, 34.9%), loss of smell (29.3%), loss of taste (26.6%), and myalgia (37.4%). Taste and smell disturbances are distinctive features of COVID-19 and are often associated with metabolic conditions such as obesity, in which inflammation can affect sensory function[22]. High fever, in addition to indicating a systemic inflammatory response, may signal complications in patients with comorbidities such as hypertension or diabetes, particularly when poorly controlled[23].

Supplementary Table 3 shows that the number of vaccine doses and vaccination status (vaccinated or not) are significantly associated with negative

COVID-19 test results (p-value = 0.002 and p-value = 0.014, respectively). Most positive cases occurred among unvaccinated individuals, whereas most vaccinated individuals tested negative, reinforcing the crucial role of vaccination in reducing infection risk. Studies confirm that unvaccinated individuals have a higher proportion of positive cases and a higher risk of hospitalization and need for advanced support[24]. In addition, social determinants such as age, income, and education influence vaccine uptake, with better coverage among older individuals and those with higher educational levels[25].

Although the findings of this study contributed to a better understanding of the characteristics of COVID-19 patients in the municipality of São Gonçalo, some limitations should be considered. First, the sampling approach adopted, based on convenience, limits the representativeness of the study. This limitation was addressed only partially by adding weights to the sample. Furthermore, the instrument used to characterize the sample is subject to recall and self-report bias, which may have influenced participants' responses. Future studies are encouraged to use more representative sampling methods, with weighting schemes planned a priori, and to adopt more objective tools for recording comorbidities in the sample.

Conclusion

Data from this cohort indicate that most participants identified as Brown and that women were more frequently represented, with the largest share of individuals falling between 21 and 50 years of age. Hypertension appeared as the most common comorbidity in the sample. Among those who tested positive, high fever, loss of smell, and loss of taste were particularly frequent and stood out as clear markers of infection. Vaccination showed the opposite pattern, aligning with lower positivity and reinforcing its role in reducing the likelihood of SARS-CoV-2 infection.

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Tables

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