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Massive and early testing of SARS-Cov2 in rural unions affiliated to FAESP-SENAR/SP

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ABSTRACT

OBJECTIVE

To describe scientific evidence that proves the relevance of screening for SARS-COV-2 cases as a strategy for epidemiological assessment of the progress of the disease in the State of São Paulo.

METHODS

489,025 tests were performed in 253 rural unions affiliated to FAESP-SENAR/SP, and the epidemiological profile of positive cases for detection of immunoglobulin M was analyzed.

RESULTS

It was observed that early testing is an important factor for the construction of control charts and, consequently, for the observation of the progress of the epidemic in the state.

CONCLUSION

It is important to perform descriptive analytical observation on the variables of the infected.

DESCRIPTORS

COVID-19, Testing, Epidemiological variables.

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INTRODUCTION

In December 2019, the city of Wuhan located in the province of Hubei, China, unfortunately witnessed an outbreak of respiratory illness with an unknown cause and epidemiologically linked to a local animal market. In January 2020, researchers identified the etiological agent of the outbreak as a novel coronavirus (named SARS-CoV-2), and named the disease Coronavirus Disease 2019, or simply COVID-19[1,2].

In the first 30 days, China reported 11,821 cases and 259 deaths. Subsequently, the disease was detected in other countries in Asia, Europe, and North America. On January 30th, 2020, the World Health Organization (WHO) declared a Public Health Emergency of International Concern (PHEIC), as there were more than 110,000 cases in 114 countries. In March 2020, the WHO declared that the emerging disease had become a pandemic[3].

The experience of China as the epicenter of the outbreak showed that non-pharmacological interventions, such as various forms of social distancing - from isolating cases and contacts to total lockdowns - could be effective in controlling the epidemic, as in other epidemics experienced by humanity. However, the applicability of these and other strategies varied in each country, and within these practices, laboratory testing performed preventively proved to be of great value in containing the spread of the disease. In Brazil, the first cases appeared and were confirmed in February 2020. Since then, various actions have been implemented with the aim of containing and slowing the spread of the disease[1].

Since the beginning of the pandemic, data on COVID-19 cases and deaths in Brazil have been collected and consolidated by State Health Secretariats and made available to the public, allowing for dynamic knowledge of the disease in the country and consequently, the establishment of policies for its containment.

Based on this history, two plans were implemented in Brazil: the Suppression Strategy and the Mitigation Strategy, based on strategies applied in Europe. Due to the context of each country and the tumultuous actions of the federal entities in Brazil, these measures complemented each other at certain times, but unfortunately opposed each other at other times[2].

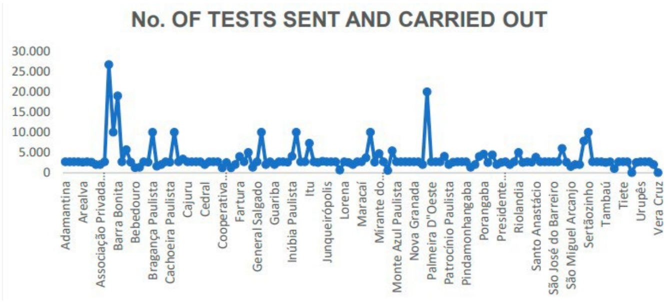
Following this premise and respecting good scientific practices, the Federation of Agriculture of the State of São Paulo (FAESP) and the Administrative Council of the National Rural Learning Service (SENAR-SP), together with the Promoting Health in the Field Program (PPSC), entered into a partnership agreement with the Union/Ministry of Health, Oswaldo Cruz Foundation (Fiocruz), and Bio-Manguinhos Institute. They developed a testing program for COVID-19 mapping, coordinated by PPSC, starting a campaign throughout the State of São Paulo. The campaign involved Rural Unions, which had the support of health secretariats of municipalities, hospitals, and philanthropic services to perform approximately 500,000 serological tests for the screening of Immunoglobulin M (IgM) in people between 10 and over 70 years old in the 253 regional entities linked to FAESP and SENAR.

Based on these data, this work aims to demonstrate that, along with distancing measures, population testing practices present themselves as an alternative to evaluate the incidence rate and analyze the epidemic frequency of COVID-19, following the strategy of the World Health Organization to evaluate the seroepidemiological profile of symptomatic or asymptomatic infected individuals[3].

METHODS

This study presents observational and ecological modeling characteristics, for which secondary data from FAESP/SENAR-SP were collected in 2021. The data were applied in 253 cities in the state of São Paulo, distributed across 28 regional departments, following the models of the State Health Secretariat (SES) during the year 2021, as shown in Figure 1.

Figure 1. Tests sent and carried out in the each Rural Syndicate. Source: Research data, 2022.



The relationships between serological testing and variables such as gender, age group, and incidence rate were analyzed based on the detection of IgM using KIT REA TR COVID-19 tests, batches 20UDV008R (27 KT) and 20UDV010Z (973 KT) - 11 KDV - 00-S-0320. With this information, we modeled descriptive data and graphical analyses that could reflect the epidemic state in the region throughout 2021, based on hypothesis testing for proportions in demographic variables such as gender, age group, and sample percentage, as shown in Table1.

Table 1. Descriptive and analytical analysis of age range and gender of the tested population throughout 2021.

Age Range	Geometric Mean and Confidence Interval	Hypothesis Test for Percentages based on Variance	Gender
10-20 years	4,60% (2,5-5,7%)	P>0,05	Male:227.199 (47,64%)
21-50 years	61,0% (59-68%)	P<0,02	Female: 249.708 (52,36%)
51-70 years	10,2% (8,5-12,5%)	P>0,05	P >0,05
Over 70 years	24,4% (20-28%)	P>0,05	-

Source: Authors

According to a study conducted, analyses were performed with the variables recorded in the statistical survey forms[5]. Frequency distributions were constructed and data parametricity was calculated using the Shapiro-Wilk goodness-of-fit test ($p<0.05$) to assess the normality of COVID-19 incidence rates. Incidence rates were verified using the Kolmogorov-Smirnov test ($p<0.05$), and hypothesis testing for proportions with respect to gender and age groups was performed with regard to the number of tests performed. All these analyses were complemented with information on the 95% confidence interval (CI), calculated with the standard error (SEa) stratified correction: $\sqrt{p(1-p)/n}$, with 95% confidence = p'-1.96xSEa and p"+1.96xSEa.

The incidence rates were calculated directly by dividing the number of positive tests by the total population. For the temporal analysis of the epidemic frequency in the region, we performed graphical analyses of the epidemic[6]. We adapted the modeling using the Cullen method, using mean +1.96 standard deviation6, as observed in Figure 2, and also adapted the method of Stern & Lightfoot. In this method, we analyzed a non-parametric smoothing, using successive medians between January and April, May and August, and September and December. We calculated the current mean (moving) - Hanning running average (H)[6] (Figure 3).

Figure 2. Control Chart of COVID-19 based on positive IgM tests, using the Cullen method. Source: Authors, 2022.

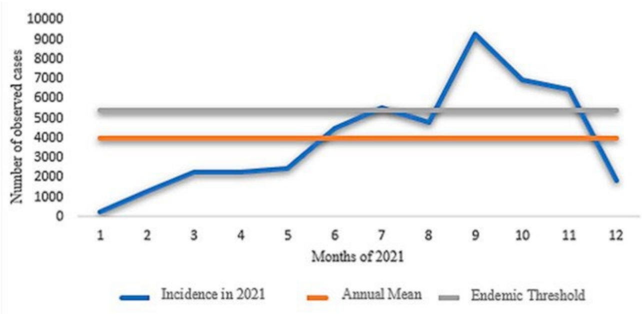
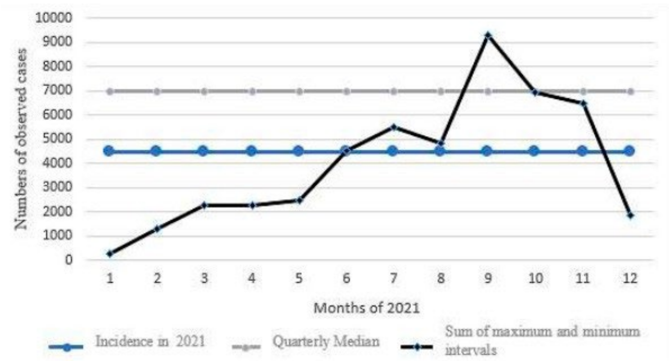


Figure 3. COVID-19 Control Diagram based on positive IgM testing, using the Stern & Lightfoot method. Source: Authors, 2022.



To calculate the current mean, the data points in time (quarters) were replaced by the following equation: H = Md for January to March + Md for April, May, and June + Md for July, August, and September + Md for October, November, and December. The application of x was made between these medians and taken as the basis for the endemic threshold, based on the minimum and maximum values, based on the analysis of malaria epidemic prediction[6].

RESULTS AND DISCUSSION

We did not observe a statistically significant difference between the proportion of testing between men and women. However, significant percentage differences were observed between the age groups of people seeking diagnoses. According to Table 1, the population between 21 and 50 years old was the most tested in this survey, which coincides with the profile of infected people in Brazil.

Regarding the incidence rates, in both graphical modeling - carried out with parameterization of the data (Figure 2), as well as the non-parametric method of analysis (Figure 3) - they coincide with explosive epidemic peaks between September and October, confirming the analysis by both modeling approaches (an average of 9,500 positive cases). These models used variance and standard deviation as thresholds, in addition to the moving average based on the median and minimum and maximum values. It is interesting to note that the frequency of positive IgM cases in the months following July and August coincides with the easing of quarantine measures imposed by the state government, which were initially in effect until August 2021, in addition to the seasonal epidemic profile of influenza-like illnesses during the coldest times of the year. During this same period of analysis, the percentage of the state's population fully vaccinated did not exceed 10% of eligible individuals at the time. This gives us room to discuss that the positive IgM data in this sample mostly refer to active cases of COVID-19.

The implementation of non-pharmacological interventions, such as social distancing measures, has proven effective in containing the epidemic, as have laboratory tests. In Brazil, two plans based on European strategies were implemented to contain the disease: the Suppression Strategy and the Mitigation Strategy.

The results obtained in the mentioned testing program can provide valuable information on the epidemic spread and frequency of COVID-19 in the studied region, as well as on the seroepidemiological profile of symptomatic and asymptomatic infected individuals. The evaluation of seroepidemiology can help determine the proportion of the population that has been infected and developed antibodies against the virus, which can be useful for understanding the dynamics of the disease and planning public health measures.

The use of observational characteristics and ecological modeling is a common approach in epidemiology to study the spread of diseases in populations. However, it is important to remember that these results represent only a specific region and cannot be generalized to other areas or populations. In addition, since the study used secondary data collected from medical and laboratory records, errors or underreporting of cases are possible, which can affect the accuracy of the results.

The results of the testing program can be useful for understanding the dissemination of COVID-19 and the seroepidemiological profile in the studied region, but it is important to exercise caution when interpreting the results and not extrapolating the conclusions to other areas or populations.

CONCLUSION

The analysis of mass testing data revealed the persistence of COVID-19, even with the emergence of new viral variants and the decrease in demand for vaccination throughout 2023. The use of control charts allowed mapping of disease incidence rates, demonstrating a significant increase after the relaxation of sanitary measures, along with the seasonality of flu-like illnesses. However, it is important to remember that new comparative data is necessary to validate the conclusions of this study and enable the establishment of more effective public policies for the primary prevention of COVID-19. In conclusion, the results obtained in the testing program demonstrated the importance of mass testing to assess the incidence and epidemic frequency of COVID-19 in a given population.

Analysis of incidence rates confirmed that September and October 2021 were the periods of epidemic peak in the state of Sao Paulo, which coincides with the relaxation of quarantines imposed by the state government.

Additionally, the detection of IgM antibodies in the subsequent months of July and August suggests the presence of active cases of COVID-19 in the tested sample. It is important to emphasize that the detection of IgG alone is not sufficient to affirm that the patient had the disease, and other types of tests, such as RT-PCR, are necessary to confirm or rule out the presence of the virus in the patients' organisms tested.

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