New Coronavirus (2019-nCoV): Analysis of the magnitude in the first two months of epidemic

ABSTRACT | Objective: To analyze the magnitude of the New Coronavirus (COVID-19) in the State of São Paulo (SSP) in the first two months of the epidemic after the confirmation of the first case. Method: Ecological, descriptive study, considering the confirmed cases of COVID-19 captured by the SSP Epidemiological Surveillance Center for the period from February 26 to April 26, 2020. Result: It was found that the municipality of São Paulo presented a greater number of cases (13,989) and deaths (1,172). However, it was not the municipality that presented the highest magnitude for health indicators of COVID-19 incidence rate, mortality and lethality. Conclusion: Um explanation for such results is the lack of testing of COVID-19 in the municipalities studied. The potential of the epidemic is still of particular concern, given the large number of people potentially susceptible to COVID19 and the magnitude of the epidemic that extrapolates world indicators in some locations.
Keywords: Coronavirus infections; Descriptive epidemiology; Ecological study.

RESUMEN | Objetivo: Analizar la magnitud del nuevo coronavirus (COVID-19) en el estado de São Paulo (ESP) en los primeros dos meses de la epidemia después de la confirmación del primer caso. Método: Estudio ecológico descriptivo, considerando los casos confirmados de COVID-19 capturados por el Centro de Vigilancia Epidemiológica ESP para el período del 26 de febrero al 26 de abril de 2020. Resultado: Se encontró em el municipio de São Paulo un mayor número de casos (13989) y defunciones (1172). Sin embargo, no fue el municipio el que presentó las más altas magnitudes para los indicadores de salud de COVID-19 tasa de incidencia, mortalidad y letalidad. Conclusión: És probable que tales resultados se deban a la falta de pruebas de COVID-19 en los municipios del Estado. El potencial de la epidemia sigue siendo motivo de especial preocupación, dada la gran cantidad de personas potencialmente susceptibles a COVID19 y la magnitud de la epidemia que extrapola los indicadores mundiales en algunos lugares.
Palabras claves: Infecciones por coronavirus; Epidemiología descriptiva; Estudio ecologico.

RESUMO | Objetivo: Analisar a magnitude do Novo Coronavírus (COVID-19) no Estado de São Paulo (ESP) nos dois primeiros meses da epidemia a partir da confirmação do primeiro caso. Método: Estudo ecológico, descritivo, considerando os casos confirmados de COVID-19 captados pelo Centro de Vigilância Epidemiológica do ESP para o período de 26 de fevereiro a 26 de abril de 2020. Resultado: Verificou-se que o município de São Paulo apresentou maior número de casos (13989) e óbitos (1172). No entanto, não foi o município que apresentou os maiores indicadores de saúde da COVID-19 (magnitudes: taxa de incidência, mortalidade e letalidade). Conclusão: É provável que tais resultados se devam à falta de testagem do COVID-19 nos municípios do Estado. O potencial da epidemia, ainda, é particularmente preocupante, dado ao grande número de pessoas potencialmente suscetíveis ao COVID19 e a magnitude da mesma que extrapola os indicadores mundiais em algumas localidades.
Palavras-chaves: Infecções por coronavírus; Epidemiologia descritiva; Estudo ecológico.

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INTRODUCTION

In December 2019, in Wuhan County, Hubei Province, China, an outbreak of pneumonia of unknown cause triggered epidemiological investigations, so that on January 7th 2020, a new highly contagious virus, Severe Acute Respiratory Syndrome Coronavírus 2 (SARS-CoV-2), cause of the severe acute respiratory syndrome, COVID-19[1], and in January 2020, the World Health Organization declared the outbreak as a public health emergency of international interest which, due to its global expansion, in March 2020, was declared a pandemic[2-4].

The spread of the agent continued until, on May 16th 2020, 4.425.285 cases of COVID-19 in the world and 302.059 deaths had already been confirmed. This series was mainly composed of notifications from the following regions: European (1.848.445 cases / 164.723 deaths); American (1.909.483 cases / 3.123 deaths); eastern Mediterranean (315.688 cases / 9.701 deaths); Western Pacific (166.721 cases / 6.697 deaths), Southeast Asia (127.995 cases / 4.201 deaths) and African (54.461 cases / 1.661 deaths)[4].

In the Americas, it draws atten-

tion to the series presented by Brazil, since, on May 16th 2020, 233.142 cases and 15.633 deaths had already been confirmed[5], being the main country affected in Latin America.[4] When considering the incidence and mortality rate of COVID-19 per 100.000 inhabitants in the country, in the same period, there are 110,9 and 7,4, respectively, with the two main regions affected being the north and southeast. Also considering the period from the confirmation of the first case to May 16th 2020, the southeast region stands out for being the second main in terms of incidence and mortality rates, with 106,2 and 8,7, respectively. [5]

The state of São Paulo stands out in the southeastern region, where the first case was reported in Brazil and Latin America, when a 61 year-old Brazilian, after a trip from February 9th to 20th, 2020 to Lombardy (northern Italy), was confirmed with COVID-19[6]. Until May 16th 2020, 61.183 cases and 4.688 deaths had been reported in this region[5].

In epidemiological surveillance, information is vital for carrying out health actions compatible with the local reality, so that obtaining greater knowledge about the distribution and frequency of COVID-19 can contribute to the understanding of the epidemiology of the disease, which underlies the interest in investigating, in a more detailed way, this problem in public health in the State of São Paulo. Given the above, the present study aimed to describe the incidence, mortality and lethality caused by the new disease, from February 26th to April 26th 2020, in the State of São Paulo.

METHODS

Epidemiological, ecological, population-based study. The population of the State of São Paulo was the object of the study, considering its dis-

tribution in the 645 cities of the state. The confirmed cases of the New Coronavirus (COVID-19) were obtained from the public domain database of the Government of the State of São Paulo - Secretary of State for Health - Disease Control Coordination - Epidemiological Surveillance Center "Prof. Alexandre Vranjac "- New Coronavirus (COVID-19) - Epidemiological Situation 26th February to 26th April 2020, available at: http://www.saude.sp.gov.br/cve-centro-de--vigilancia-epidemiologica-prof.-alexandre-vranjac/areas-de-vigilancia/doencas-de-transmissao-respiratoria/coronavirus-covid-19/situacao-epidemiologica.

To calculate the incidence and mortality rates, the population obtained from the website of the Brazilian Institute of Geography and Statistics (IBGE) 2019 was used. The incidence and mortality rates per 100.000 inhabitants were calculated from the ratio between the number of cases confirmed and deaths, respectively (numerator) and resident population (denominator). Lethality per 100 cases was calculated from the ratio between the number of deaths (numerator) and

confirmed cases (denominator). For data analysis, descriptive statistics were used, applying the Softwares TabWin 3.6b and Microsoft Excel 2016.

The research did not need to be approved by the Research Ethics Committee, since the secondary data from COVID-19 obtained for analysis in this study are in the public domain and did not present patient identification, thus following the principles established by Resolution No. 466, of December 12th 2012, which provides for regulatory guidelines and standards for research involving human beings.

RESULTS

The first case of COVID-19 in the State of São Paulo was confirmed on February 25th 2020 in the city of São Paulo. After two months of the COVID-19 epidemic (April 26th 2020), the State of São Paulo already had 21.696 confirmed cases in 288 cities (44,65% of the 645 municipalities), with the city of São Paulo being the most affected (64,48%) (Image 1).

For the studied period, the State of São Paulo presented the inciden-

Image 1 - Distribution of confirmed cases of the New Coronavirus (2019-nCoV), by municipality of residence. State of São Paulo, February 26th to April 26th, 2020.
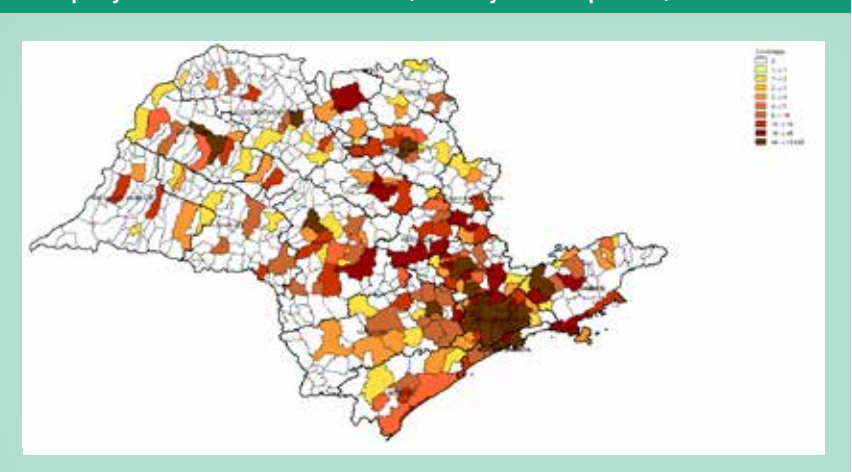
Source: São Paulo State Government / State Health Secretariat / Disease Control Coordination / Epidemiological Surveillance Center "Prof. Alexandre Vranjac "- New Coronavirus (COVID-19) - Epidemiological Situation 61

ce rate of COVID-19 of 47.25 cases per 100.000 inhabitants, whose cities with the highest rates were: Arandu (141,58 cases per 100.000 inhabitants), Ilha Comprida (116,42 cases for every 100.000 inhabitants), São Paulo (114,18 cases for every 100.000 inhabitants), Santos (106,85 cases for every 100.000 inhabitants) and Jaci (113,2 cases for every 100.000 inhabitants) (Image 2).

The first death by COVID-19 was registered on March 17th 2020 in the city of São Paulo and on April 26th, the State of São Paulo confirmed 1825 deaths in 131 cities (20,31% of the 645 cities). The city of São Paulo had the highest number of deaths (64,22%) (Image 3).

The mortality rate of COVID-19 in the State of São Paulo was 3,97 cases for every 100.000 inhabitants, with

the cities with the highest rates: Arandu (31,46 cases for every 100.000 inhabitants), Caiabu (23,86 cases for per 100.000 inhabitants), Presidente Venceslau (15,18 cases per 100.000 inhabitants), Santo Antonio da Alegria (14,43 cases per 100,000 inhabitants) and Lavrinhas (13,77 cases per 100.000 inhabitants) (Image 4).

The ratio between the number of deaths and confirmed cases (lethality) by COVID-19 in the State of São Paulo was 8,41 for every 100 cases. The cities of Caiabu, Conchas, Iepê, Jarinu, Juquitiba, Pitangueiras, Rincão, Salesópolis, Santa Rita do Passa Quatro, Santo Antônio da Alegria and Serrana presented 100% of this indicator (Image 5).

DISCUSSION

The identification of potentially risky areas for infectious diseases and the factors that influence their spatial distribution is relevant for public health authorities to implement effective prevention and control measures[7]. In order to describe the spatial patterns that can help in understanding the factors that may influence the risk of contracting the disease, an ecological study was conducted that compared the magnitude of the incidence, mortality and lethality indicators of the New Coronavirus epidemic (COVID-19 disease) between the cities of the state of São Paulo for the period of two months. Such data may serve as a reference for comparison with data for the period of three months, or more, to assess the impact of the measures adopted and the evolution of the disease.

The incidence and mortality rates for the city of São Paulo were 114,2 and 9,6, respectively, much higher than those observed worldwide. Considering all cases since the beginning of the pandemic until May 14th the incidence rate was 57,4 cases per

Image 2 – Distribution of the Incidence Rate per 100.000 inhabitants of the New Coronavirus (2019-nCoV), by municipality of residence. State of São Paulo, February 26th to April 26th, 2020.

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Image 3 – Distribution of confirmed deaths from the New Coronavirus (2019-nCoV), by municipality of residence. State of São Paulo, February 26th to April 26th, 2020.
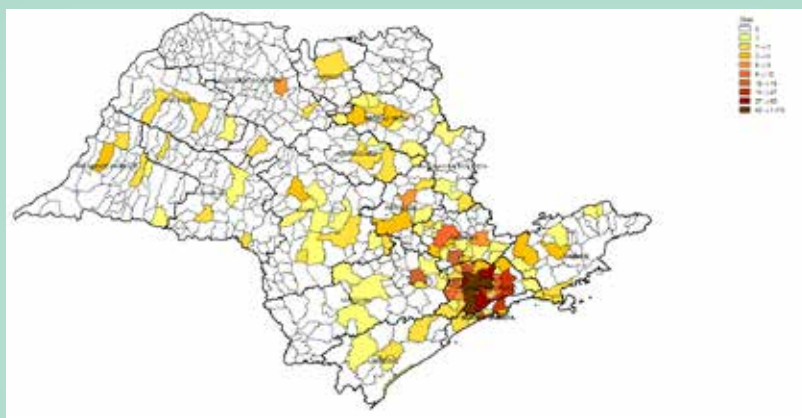
Source: São Paulo State Government / State Health Secretariat / Disease Control Coordination / Epidemiological Surveillance Center "Prof. Alexandre Vranjac "- New Coronavirus (COVID-19) - Epidemiological Situation 61

Image 4 – Distribution of the Mortality Rate per 100.000 inhabitants of the New Coronavirus (2019-nCoV), by municipality of residence. State of São Paulo, February 26th to April 26th, 2020.

Source: São Paulo State Government / State Health Secretariat / Disease Control Coordination / Epidemiological Surveillance Center "Prof. Alexandre Vranjac "- New Coronavirus (COVID-19) - Epidemiological Situation 61

Image 5 – Lethality distribution per 100 cases of the New Coronavirus (2019-nCoV), by municipality of residence. State of São Paulo, February 26th to April 26th, 2020.
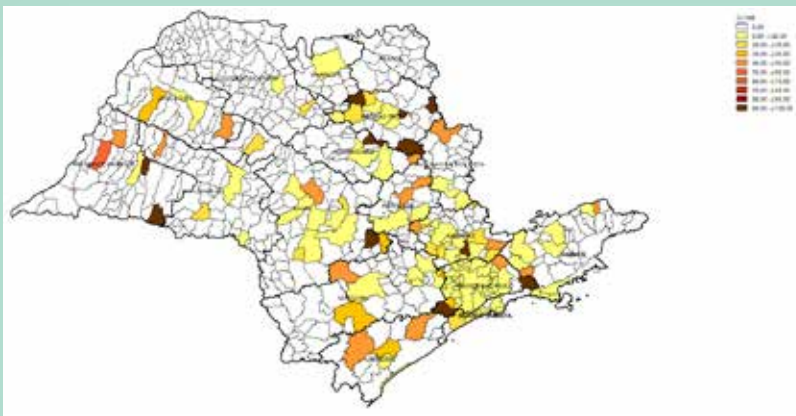
Source: São Paulo State Government / State Health Secretariat / Disease Control Coordination / Epidemiological Surveillance Center "Prof. Alexandre Vranjac "- New Coronavirus (COVID-19) - Epidemiological Situation 61

100.000 inhabitants and the mortality rate was 3,8 deaths per 100.000 inhabitants[8].

Due to the large population concentration and more unequal socioeconomic conditions, China's megacities (Beijing, Guangzhou, Shanghai and Shenzhen) were faced with greater tensions from the COVID-19 outbreaks. These megacities are not only nuclei of China's economy, but also have global influences on world economies. Also, they present regions with a large floating population, which was considered an important influencing factor for the spread of the infection[9]. The same happens with the municipality of São Paulo.

It was observed that the distribution of cases in Chinese megacities was characterized by the existence of family clusters of cases (Beijing and Guangzhou) and great importance of imported cases in the total observed (Guangzhou and Shenzhen). Beijing, Guangzhou and Shenzhen presented different patterns of distribution of COVID-19 cases and different influencing factors for these patterns, which highlighted the importance of socioeconomic factors, with emphasis on population density, the number of supermarkets and bus stops, as well as as the daily migration of people from neighboring cities, justified by the transmissibility characteristic of the disease from person to person[9].

Municipalities close to the capital also had a high incidence and mortality. This pattern was not observed for lethality. According to the literature, neighboring regions tend to have more similar rates than distant region[10]. The movement of the population between the cities of Greater São Paulo and the neighboring municipalities favors the dissemination of the agent, as has already been said.

Considering the cities furthest from the state capital, there are differences between those with the highest magnitudes for each indicator studied. The municipalities with the highest magnitudes for incidence rates were Arandu (141,6 cases per 100.000 inhabitants - greater than that observed for the state capital), Jaci (113,2 cases per 100.000 inhabitants), Borebi (75,4 cases for 100.000 inhabitants) and Agudos (40,3 cases per 100.000 inhabitants).

The highest mortality rates were observed in Arandu (31,5 deaths per 100.000 inhabitants), Caiabu (23,9 deaths per 100,000 inhabitants), Presidente Venceslau (15,2 deaths per 100.000 inhabitants), Santo Antonio da Alegria (14,4 deaths per 100.000 inhabitants) and Lavrinhas (13,8 deaths per 100.000 inhabitants) - all higher than those observed for the state

capital. According to the publication Basic Indicators for Health in Brazil: concepts and applications[11], the specific mortality rate from communicable diseases estimates the risk of death from the disease considered in the total population of the geographic area in question in a given period of time. It portrays the incidence of this disease in vulnerable population segments, associated with the conditions of socioeconomic development and environmental infrastructure. It also reflects the effectiveness of prevention and control measures, as well as the conditions for diagnosis and medical assistance offered to the population.

Arandu was the city whose magnitudes of incidence and mortality were the highest in the state. It had 6.123 inhabitants in the last census (estimated population of 6.357 in 2019). Its HDI is 0,685, considered average. In 2017, the average monthly wage was 1,9 minimum wages and the proportion of employed persons in relation to the total population was 17,1%. Considering households with monthly income of up to half a minimum wage per person, it had 29,1% of the population in these conditions. The municipality had only two health establishments in the Unified Health System (SUS) and 20 beds for hospitalization in 2009.[12] The data suggest poor working conditions, income and access to health. However, we cannot attribute the impact of the disease in the region to these characteristics of the municipality, since the number of confirmed cases in the region was small (nine). The fact that the population of the municipality is small seems to be the one that best justifies the findings.

Lethality ranged between 0.9% and 100%. An ecological study conducted with data from countries with more than 200 reported cases of the new coronavirus analyzed demographic variables, health expenditure

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and characteristics of health services as exposure variables, in addition to incidence, mortality and lethality rates as response variables.[13] The number of disease diagnostic tests and the number of doctors were associated with a higher incidence of the disease. There was no association between mortality and lethality and demographic variables, health expenditure or health services. These findings may justify the high lethalities observed in other municipalities in the state of São Paulo - in 24 of them, it varied between 54% and 30% and in another 20, between 28% and 20% - because the investigation of patients was not performed more widely in the population, even though the study cited considered locations with more than 200 cases of the disease, which does not apply to cases that had high lethalities in the present study.

Another hypothesis is that the number of cases of the disease has been very small and that the few cases have led to death - which may justify the 100% lethality in 11 municipalities in the state. According to World-o-Meter data for May 14th the lethality of the disease in the world is 6,7% (4.471.418 confirmed cases worldwide and 299.612 deaths). It is suggested that the hypothesis that lethality is so much higher in these municipalities by underestimating cases is investigated, since, according to a recent publication, solid (good quality) evidence is needed to combat health inequities during the outbreak of COVID-19. Without them, the assessment of health equity will be impossible, which will reduce the impact of disease control efforts.[14] Furthermore, ensuring diagnosis and treatment opportunities for all is seen as an important factor in winning the battle against the disease.[14]

As already mentioned, the study is ecological and descriptive, con-

ducted with data from the first two months of the epidemic in the State. Also, it is retrospective and the update of the data may point to an epidemiological situation different from that described. The greatest limitation of the analysis of ecological data conducted in the present study is related to the heterogeneity between the groups studied in the level of exposure to the disease[10] and the factors that influence its impact as a public health problem, such as the age structure of the population, the extent of case investigation, timely access to health services, adoption of social isolation measures and other measures to reduce risk of contagion are not known. Such factors were not included in the analyzes, given the limitation of the referred database. Besides that, conducting a simple comparison of the indicators between the regions studied can be complicated, as regions with a small number of observed cases show great variability for the estimated rates[10]. Thus, the highest rates tend to be observed in small municipalities,

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as can be observed, probably due to clusters of cases.

CONCLUSION

The potential of the epidemic in certain cities in the state of São Paulo is of particular concern, given the large number of people potentially susceptible to COVID19.

The capital of the state of São Paulo was the region studied most affected by COVID19: 13.989 confirmed cases and 1.172 deaths for the period studied. However, the municipality of São Paulo did not present higher rates of incidence, mortality and lethality.

The results of this study include fundamental information for public health assistants and managers in decision-making, time-sensitive, at the municipal and state levels, in view of the use of maps of incidence, mortality and lethality rates that can be used in temporary comparisons that allow a better assessment of the disease evolution and the effects of the measures adopted, in addition to decisions aimed at prevention and control of the New Coronavirus (2019-nCoV).

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