

Epidemiological data and the importance for the COVID-19 pandemic control in Brazil

O cenário dos dados epidemiológicos descritivos e a importância para o controle da pandemia de COVID-19 no Brasil

El escenario de datos epidemiológicos descriptivos y la importancia para el control de la pandemia COVID-19 en Brasil

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ABSTRACT

Background and objectives: in Brazil, access to the epidemiological data of COVID-19 is scarce. Thus, it was described aspects that could be better disclosed for use in public health decision making. **Methods:** census data were collected on the number of cases and deaths, lethality, incidence and mortality per hundred thousand inhabitants, severe acute respiratory syndrome (SARS) caused by SARS-CoV-2 or other virus, % of intensive care unit occupancy and social isolation, number of tests of RT-PCRs and % of tests performed against the total of samples collected. **Results:** there was an increase in the number of SARS in 2020 compared to cases from previous years. The number of RT-PCR tests was performed, mainly in critically ill patients with COVID-19. Some states in Brazil performed an analysis of the material collected for RT-PCR from only a portion of individuals. In Brazil, there is an apparent underreporting of cases of the disease, which can comprise about 44 thousand individuals in serious condition or deaths, as well as more than about 700 thousand individuals with mild severity or asymptomatic. **Conclusion:** in Brazil, there is limited access to the information that characterizes the reality of the moment in which citizens live before the COVID-19 pandemic. Epidemiological data, mainly referring to the number of new cases, deaths and hospitalizations by COVID-19 and analysis of adherence to social isolation are extremely important to enable decision-making for better management of COVID-19 in national and international level.

Keywords: Brazil. Epidemiology. Social Isolation. Polymerase Chain Reaction. SARS-CoV-2.

RESUMO

Justificativa e objetivos: no Brasil, o acesso aos dados epidemiológicos da COVID-19 é escasso. Dessa forma, foram descritos os aspectos que poderiam ser divulgados para o uso nas tomadas de decisão de saúde pública.

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Métodos: foram coletados dados do censo sobre o número de casos e de óbitos, letalidade, incidência e mortalidade por cem mil habitantes, Síndrome Respiratória Aguda Grave (SRAG) causada pelo SARS-CoV-2 ou outro vírus, % de ocupação de unidade de tratamento intensiva e de isolamento social, número de testes de RT-PCRs e % de testes realizados perante o total de amostras coletadas. **Resultados:** houve um aumento no número de SRAG em 2020 se comparado aos casos de anos anteriores. O número de testes de RT-PCRs foi realizado, principalmente em pacientes graves com COVID-19. Alguns estados do Brasil realizaram a análise do material coletado para a RT-PCR de apenas uma parcela de indivíduos. No Brasil, existe uma aparente subnotificação de casos da doença e que pode compreender aproximadamente 44 mil indivíduos em estado grave ou de óbitos, bem como mais de aproximadamente 700 mil indivíduos com gravidade leve ou assintomáticos. **Conclusão:** no Brasil, tem-se acesso limitado a informações que caracterizem a realidade do momento em que se vive perante a pandemia de COVID-19. Os dados epidemiológicos, principalmente referentes ao número de novos casos, de óbitos e de internações pela COVID-19 e a análise da adesão ao isolamento social são de extrema importância para viabilizar a tomada de decisões para o melhor manejo da COVID-19 em caráter nacional e internacional.

Descritores: Brasil. Epidemiologia. Isolamento Social. Reação em Cadeia da Polimerase. SARS-CoV-2.

RESUMEN

Justificación y objetivos: en Brasil, el acceso a los datos epidemiológicos de COVID-19 es escaso. Así, se describieron aspectos que podrían ser divulgados para su uso en la toma de decisiones de salud pública. **Métodos:** se recopilaron datos censales sobre el número de casos y defunciones, letalidad, incidencia y mortalidad por cada 100.000 habitantes, Síndrome Respiratorio Agudo Severo (SRAS) causado por el SRAS-CoV-2 u otro virus,% de ocupación de la unidad de cuidados intensivos y aislamiento social, número de pruebas de RT-PCR y% de pruebas realizadas frente al total de muestras recogidas. **Resultados:** hubo un aumento en el número de SARS en 2020 en comparación con los casos de años anteriores. Se realizó el número de pruebas de RT-PCR, principalmente en pacientes críticos. Algunos estados en Brasil realizaron el análisis del material recolectado para RT-PCR de solo una porción de individuos. En Brasil, existe un registro ineficaz aparente de casos de la enfermedad, que puede comprender acerca de 44 mil personas en estado grave o muerte, así como más de acerca de 700 mil personas con gravedad leve o asintomáticas. **Conclusión:** en Brasil, existe un acceso limitado a la información que caracteriza la realidad del momento en que se vive la pandemia de COVID-19. Datos epidemiológicos, principalmente referidos al número de nuevos casos, de muertes y hospitalizaciones por COVID-19 y el análisis de adherencia al aislamiento social son de suma importancia para posibilitar la toma de decisiones para el mejor manejo del COVID-19 en carácter nacional e internacional.

Palabras clave: Brasil. Epidemiología. Aislamiento Social. Reacción en Cadena de la Polimerasa. SARS-CoV-2.

INTRODUCTION

Coronavirus Disease 2019 (COVID-19), a disease caused by Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) infection, emerged in Wuhan in China in 2019 and was declared a pandemic by the World Health Organization (WHO) in March 2020, with repercussions on the world social and economic scenario.¹ COVID-19 affected over 7 million people worldwide, and on June 10, 2020, the following scenario in the World (and in Brazil; Brazil's position in the world ranking) was described: 7,447,151 (775,184; 2nd place) cases of the disease; 418,135 (39,797; 3rd place) deaths caused by the disease; 3,730,056 (380,300; 2nd place) patients recovered clinically from the disease; 3,298,960 (355,097; 2nd place) active cases and in follow-up; 53,812 (8,318; 3rd place) serious cases and being followed up by the health system; 955 (3,648; 30th place) cases confirmed by one million inhabitants; 53.6 (187; 19th place) deaths per one million inhabitants.² On the same date, in relation to the number of real time-polymerase chain reactions (RT-PCRs) specific to SARS-CoV-2, Brazil had carried out a total of 1,182,581 tests in specialized laboratories, 5,666 of which were performed by a million

inhabitants; thus, the country occupied the 126th position in the ranking of tests per one million inhabitants in the world compared to other territories.²

In health surveillance, taking the Brazilian context as an example, it is necessary that knowledge about the factors determining the presence and progression of a disease be described and made available. Among the factors, the need to detect and prevent the disease through the correct quantification and notification to be performed in health systems can be highlighted. However, in many cases, especially in pandemic situations, there may be underreporting and the presence of discrepancies in epidemiological data in relation to the impact of the disease on the community.³

In Brazil, there are sentinel units for the registration of Severe Acute Respiratory Syndrome (SARS) that work in the registration, investigation and diagnosis of suspected and confirmed cases of SARS. Sentinel units, according to Ordinance 183 of January 30, 2014 by the Ministry of Health, aimed to register at least 80% of cases of SARS in Intensive Care Units (ICUs) and to register 90% of the weeks epidemiological aspects of hospitalization aspects of SARS cases. In the ordinance, the justification

for assessing the decision-making on the financial transfer according to the status described for SARS is liable.⁴

In the world and, mainly, in Brazil, the limitation to obtain original and correct data, consistent with the impact of the pandemic in the community through census, has been described as an obstacle. Concomitantly, in Brazil, there have been changes in the Ministry of Health's approach to the official epidemiological description of the disease, mainly regarding the number of deaths associated with COVID-19. The described fact made it more difficult to obtain concrete and evolutionary data for COVID-19 in Brazil. Thus, there was a discrepancy between different sources of information about the disease and a greater difficulty in carrying out comparative studies between the national and international scenario.

The difficulty in obtaining information that represents the COVID-19 pandemic scenario regarding epidemiological data, including the number of cases of patients colonized by the SARS-CoV-2 virus (asymptomatic) or infected by the virus with mild symptom severity, is a landmark in Brazil. During the pandemic COVID-19, the Brazilian scenario was characterized by the public health policy adopted by the Ministry of Health for testing the SARS-CoV-2 virus, mainly aimed at analyzing severe cases of the disease. As observed in the literature, in some places, there was an increase in SARS diagnosis compared to other years, which may reflect limitations in diagnosing COVID-19, mainly by performing RT-PCR tests for the SARS-CoV-2 virus.⁵⁻⁷ Thus, the present study aimed to describe the overview of COVID-19 in Brazil regarding the presentation of epidemiological data and its importance for the control of COVID-19 pandemic caused by the SARS-CoV-2 virus. In the study, data on the COVID-19 pandemic in Brazil were described with an elucidative character of its importance for the correct direction of governmental decision-making and to highlight the importance of understanding the processes involved with the nuance of health and disease in the character prospective evolution of the disease in a single territory.

METHODS

The study was conducted by an active search in different databases that had free access to data about the COVID-19 pandemic in Brazil. All data were accounted for on the different platforms for the date of June 12, 2020, a period in which there was a change in the presentation of data made by the Ministry of Health of Brazil.⁸

The data referring to the number of cases of COVID-19, number of deaths associated with the disease, lethality, number of patients and number of deaths per 100 thousand inhabitants, were collected on various platforms with data from Brazil (national) and international, being them: (a) COVID-19 pandemic of the World Health Organization (<https://www.who.int/emergencies/diseases/novel-coronavirus-2019>);¹ (b) Word of Meters (<https://www.worldometers.info/coronavirus/country/brazil/>);² (c) Epidemiological Surveillance of the State Department of Health (<https://www.saude.go.gov.br/>

[vigilancia-em-saude/vigilancia-epidemiologica](https://www.saude.go.gov.br/));³ (d) Ministry of Health website (<https://www.saude.gov.br/>).⁹

Data on the prevalence of SARS caused by the SARS-CoV-2 virus, SARS caused by other infectious agents and the prevalence of SARS in the period between 2015 and 2019 were acquired on the website of *Fundação Instituto Oswaldo Cruz* (FioCruz) - InfoGripe (<http://info.gripe.fiocruz.br/>).⁵

The percentage of ICU occupancy during the pandemic, the percentage of social isolation, the total number of SARS-CoV-2 RT-PCR tests performed and the percentage of tests performed against the total of samples collected according to the states and the Federal District of Brazil are presented in the study and were obtained on the following platforms: (a) Epidemiological Surveillance of the Department of State for Health (<https://www.saude.go.gov.br/vigilancia-em-saude/vigilancia-epidemiologica>);³ (b) Ministry of Health website (<https://www.saude.gov.br/>);⁹ (c) website that reflects the Brazilian map of COVID-19 (<https://mapabrasileirodacovid.inloco.com.br/pt/>);¹⁰ (d) São Paulo State Government website, which tabulated the level of social isolation in the state during the pandemic for some cities (<https://www.saopaulo.sp.gov.br/coronavirus/isolamento/>).¹¹

Due to the ease of access to data, the status of São Paulo's regional indicators for hospital capacity, the evolution of the pandemic and decision-making were presented in the study as models for addressing the economic factor with the correct management of patients with COVID-19 in the social perspective. All the information was compiled by the use of information present in the legislation of the city of São Paulo and the legislation of the state of São Paulo.^{12,13}

The average value of SARS cases in Brazil, prior to the COVID-19 pandemic period, was calculated using the data recorded from 2015 to 2019 by InfoGripe.⁵ After calculating the annual mean, an adjustment was made to weight the cases corresponding to the initial five months of the year, i.e., between January and June, which reflects the analysis period of this study. The value obtained in the described calculations was used to estimate the index of probable underreporting of serious cases of COVID-19 in Brazil according to the state and the Federal District. The index was calculated by the difference between the average number of SARS cases and the number of SARS cases registered in 2020 after excluding confirmed cases of COVID-19.

The epidemiological data analyzed in the study were associated with each other using the Spearman correlation in the Statistical Package for the Social Sciences software (IBM SPSS Statistics for Macintosh, version 25.0). An alpha error of 0.05 was adopted in the correlations carried out between the study markers.

RESULTS

Brazil is a country with a large territorial extension and with high social, ethnic and economic diversity among the different regions that make up its territory and that reflect regional particularities to deal with the COVID-19

pandemic were scarce and had low success and reach. On July 12, 2020, 2,749 cases were confirmed in the indigenous population, including 97 deaths. For this population, the best management is social isolation. However, due to the progression of environmental

degradation through deforestation, mining and land use, contact with other individuals has been optimized in recent years, and current environmental policies have provided an exponential increase in forest degradation in Brazil, especially in Amazon. Regarding

Table 1. Descriptive analysis of the COVID-19 pandemic overview by the status of the infection by the SARS-CoV-2 virus, occupancy of intensive care units and diagnostic tests according to the states of Brazil and the Federal District.

Region	N	Death	Lethality	Incidence/100 thousand inhab.	Mortality/100 thousand inhab	SARS due to COVID-19	SARS due to other causes	SARS/ COVID-19	% ICU occupancy	Social isolation (%)	RT-PCR processed (%)	RT-PCR performed
Center-West region	33,791	614	1.82	207.3	3.8							
Federal District	19,433	256	1.32	644.5	8.5	108	1,055	9.77	77.2%a	39.35%	84%	167,228
Mato Grosso do Sul	2,597	24	0.92	93.5	0.9	34	909	26.74	8.80%	36.07%	88%	14,806
Mato Grosso	4,602	146	3.17	132.1	4.2	77	503	6.53	37.60%	37.7%	45%	10,037
Goiás	7,159	188	2.63	102	2.7	91	798	8.77	62.60%	35.36%	92%	12,925**
South region	34,044	775	2.28	113.6	2.6							
Rio Grande do Sul	13,619	316	2.32	119.7	2.8	432	2,635	6.10	72.50%	38.16%	45%	12,508**
Santa Catarina	12,594	184	1.46	175.8	2.6	207	1,500	7.25	61.60%	38.92%	48%	33,000
Paraná	7,831	275	3.51	68.5	2.4	360	3,990	11.08	47%	38.17%	95%	45,928
North region	160,767	7,385	4.59	872.3	40.1							
Amapá	14,623	289	1.98	1,729	34.2	5	29	5.80	98.73%	43.18%	63%	26,630
Rondônia	9,850	267	2.71	554.2	15	4	77	19.25	77.90%	47.83%	81%	32,863
Acre	8,746	237	2.71	991.7	26.9	0	77	NA	79.10%	43.91%	4%	19,217
Pará	62,095	3,927	6.32	721.8	45.6	74	668	9.03	70.50%	39.06%	90%	68,546
Roraima	6,347	182	2.87	1,047.8	30	9	30	3.33	ND	38.87%	92%	718*
Tocantins	6,257	120	1.92	397.8	7.6	7	172	24.57	60%	34.59%	92%	70.95**
Amazonas	52,849	2,363	4.47	1,275.1	57	569	1,196	2.10	66%	41.88%	91%	107,738
Northeast region	272,280	12,561	4.61	477.1	22							
Pernambuco	41,935	3,531	8.42	438.8	36.9	501	2,259	4.51	76%	42.22%	89%	74,400
Alagoas	18,176	660	3.63	544.6	19.8	67	166	2.48	79%	40.73%	33%	18,048
Ceará	71,402	4,480	6.27	781.9	49.1	770	2,470	3.21	76.47%	42.66%	77%	164,674
Sergipe	10,615	264	2.49	461.8	11.5	23	146	6.35	58.90%	38.45%	81%	26,330
Piauí	8,359	283	3.39	255.4	8.6	72	718	9.97	63.20%	41.33%	63%	67,226
Bahia	32,685	975	2.98	219.8	6.6	181	1,475	8.15	72%	39.69%	91%	81,392
Paraíba	24,032	559	2.33	598.1	13.9	41	633	15.44	69%	42.38%	53%	70,100
Maranhão	53,508	1,322	2.47	756.3	18.7	34	883	25.97	84.17%	39.25%	73%	66,717
Rio Grande do Norte	11,568	487	4.21	329.9	13.9	110	317	2.88	88%	41.29%	68%	31,247
Southeast region	271,534	18,345	6.76	307.3	20.8							
São Paulo	156,316	9,862	6.31	340.4	21.5	8,469	25,299	2.99	69.10%	38.84%	73%	87,463
Espírito Santo	23,344	936	4.01	580.9	23.3	53	426	8.04	84.59%	37.42%	75%	66,238
Rio de Janeiro	74,373	7,138	9.60	430.8	41.3	1,338	5,131	3.83	80%	40.77%	58%	25,308
Minas Gerais	17,501	409	2.34	82.7	1.9	336	4,852	14.44	72%	36.33%	61%	26,041

*Data updated in April 2020; **Data updated in May 2020; a54.3% of capacity in the public health system; NA - not applicable; ND - not declared; SARS - severe acute respiratory syndrome; ICU - Intensive Care Unit; RT-PCR - real time-polymerase chain reaction to identify the SARS-CoV-2 virus; % - percentage. Described data were obtained on the COVID-19 platform of the Ministry of Health and by assessment of the health departments of all states and the Federal District. Social isolation was achieved on the InLoco basis by the Brazilian map of the COVID-19 pandemic.

pandemic and other diseases.^{15,16} Data referring to the number of cases and deaths associated with COVID-19, lethality of the disease, incidence and mortality per 100 thousand inhabitants, SARS per confirmed COVID-19 or other causes, percentage of ICU occupancy and social isolation, the number of SARS-CoV-2 RT-PCRs performed and the percentage of tests performed relative to the total of samples collected to perform the SARS-CoV-2 RT-PCRs are shown in table 1.

In the data described, the greater number of confirmed cases in the Northeast than in the Southeast is noteworthy. The COVID-19 pandemic started in the Southeast, the region of Brazil with the largest number of inhabitants and with the greatest flexibility of transit of individuals on a national and international basis. The Southeast has the largest number of beds in the ICUs, greater capacity to process the RT-PCR exams of the SARS-CoV-2 and the best data control regarding the COVID-19 pandemic.

In Brazil, the highest lethality rates were described in the states of Rio de Janeiro and Pernambuco, respectively, being 9.6 and 8.42; followed by the states of Pará, Ceará and São Paulo, with a value of approximately 6.3. Among the states, the highest mortality per 100 thousand inhabitants occurred in the states of Amazonas, Ceará and Pará, with a value of 57, 49.1 and 45.6, respectively. All states and the Federal District showed a high ratio between the number of SARS and the number of confirmed cases of COVID-19, with a maximum value of 26.77 in Mato Grosso do Sul. Interestingly, the state of Mato Grosso do Sul is the one with the lowest number of cases and deaths associated with COVID-19 (Table 1).

The ICU occupancy rate was over 80% in five states in Brazil (Amazonas, Maranhão, Rio Grande do Norte, Espírito Santo and Rio de Janeiro). In all states and the Federal District, the isolation rate was less than 50%.

From the nasopharynx material collected to perform RT-PCR tests for the SARS-CoV-2 virus, one state processed only 4%; a state, between 30% and 40%; three states, between 40% and 50%; two states, between 50% and 60%; four states, between 60% and 70%; finally, four states, between 70% and 80% of the samples collected, mainly from patients with the highest degree of disease severity (Table 1). Finally, the high number of SARS-CoV-2 RT-PCR tests carried out in the Federal District is noteworthy, since it presented the largest number of tests performed in Brazil and had only three million inhabitants. The Federal District is where representatives of the federal government are concentrated, including the three branches (executive, legislative, and judicial).

DISCUSSION

Considering the importance of epidemiological data, some aspects can be highlighted and discussed despite information that has been released so far about the COVID-19 pandemic in Brazil, which includes:

SARS-CoV-2 identification by RT-PCR

In Brazil, RT-PCR was recommended to identify infection by the SARS-CoV-2 virus, especially in patients with a greater degree of disease severity.¹⁴

COVID-19 is characterized by different clinical signs, with subgroups of asymptomatic, mild symptomatic and severe symptomatic patients. Asymptomatic patients are classified as those who tested positive for the SARS-CoV-2 virus, but there is no clinical manifestation of the disease. Symptoms such as body pain, diarrhea, sore throat, conjunctivitis, headache, loss of smell and/or taste, skin rash and discoloration of the feet are considered mild symptoms of the disease and require home care.^{16,17} Serious symptoms, such as difficulty in breathing, loss of speech and/or movement, pain and tightness in the chest, are important signs that need attention and medical assessment in a referenced unit.^{16,17} The manifestations of clinical signs can appear about five days after contact with the SARS-CoV-2 virus and can last for up to fourteen days. Because of this, RT-PCR tests for the SARS-CoV-2 virus have become necessary to recognize possible transmitting agents, in addition to enabling large-scale differential diagnosis.

However, in Brazil, patients with COVID-19 and in need of hospitalization were preferentially eligible patients to collect nasopharyngeal material and further analysis by RT-PCR of the SARS-CoV-2 virus. Thus, asymptomatic patients and/or those with mild symptoms were not tested, which may have optimized the virus spread in the population due to the lack of knowledge of the actual prevalence of the disease or the expansion of the virus throughout the country. Concomitantly, asymptomatic individuals who had contact with patients with COVID-19 were also not selected for screening by the SARS-CoV-2 virus RT-PCR.

In Brazil, there are few institutions and/or laboratories with the necessary and available equipment to perform RT-PCR identification for SARS-CoV-2. With the expansion of the pandemic in the world, there was an increase in costs for obtaining equipment and supplies for COVID-19 diagnosis. Brazil, even though it is considered the second country with the highest number of cases in the world, occupied 130th position in relation to the number of tests per million inhabitants; at the moment, in Brazil it is impossible to perform RT-PCR tests to identify the SARS-CoV-2 virus en masse, as has been the case in some countries.

Although the collection of material for the RT-PCR of the SARS-CoV-2 virus was performed only in patients with greater clinical severity than COVID-19, the tests were not completed on all samples. In Brazil, it is noteworthy that five states did not perform at least the analysis of 50% of the samples collected, whereas in Acre, only 4% of the samples were processed. The inclusion of all results needs to be optimized so that we can at least estimate the number of real cases of COVID-19 among inpatients and those with severe SARS symptoms. In addition, part of the collected material was lost due to errors in the descrip-

tion of patient samples, storage and/or transportation problems, as described in the state health departments.¹⁸ However, the correct number of material losses has not been described by Brazil so far and we will hardly have access to this information. Additionally, the time between the collection, the processing of the collected material and the disclosure of the exam results needs to be reduced so that patient management, especially in hospital, is carried out according to their effective diagnosis.

Adherence to social isolation by the Brazilian population

Since the beginning of the COVID-19 pandemic, the importance of social isolation has been advocated, in order to slow the progression of new infections and which could lead to an increase in the demand for ICU admissions, causing the collapse of health systems and a high mortality rate.¹⁹⁻²¹ The collapse of the health system can occur, mainly, in states where the availability of beds is small in relation to the total number of inhabitants or where the concentration of beds occurs in regions with a higher number of inhabitants, mainly capitals.

In Brazil, the rate of social isolation occurs and occurred in a heterogeneous manner among states, having a strong influence on the action of decisions taken by local, state and federal governments. At the beginning of July 2020, the states of Rondônia, Acre, Sergipe and Goiás had the lowest isolation rates in Brazil, 55.18%, 53.63%, 44.22% and 43.56%, respectively.¹⁰ However, changes were observed regarding the need to reactivate commercial activities aiming at economic improvement under pressure from the federal government, together with the misunderstanding despite the possibility of treatment and the actual transmission of the virus by asymptomatic individuals, which caused a reduction of adherence to social isolation in all states of Brazil and the Federal District. Thus, on July 9, even in the face of a progressive increase in the number of cases and deaths by COVID-19 in Brazil, adherence to social isolation was less than 50% in all states and in the Federal District. At this time, the lowest rates were 34.59%, 35.36%, 36.07% and 36.33%, respectively, for the states of Tocantins, Goiás, Mato Grosso do Sul and Minas Gerais. São Paulo, the state with the largest population in Brazil, had an adherence of 38.84%; Rio de Janeiro, the state with the highest lethality, had an adherence of 40.73%.

The values of adherence to social isolation from the literature and from government or private health platforms do not represent the real scenario in Brazil, with data obtained only by assessing part of the population and, mainly, for cities with a higher number of inhabitants. Together, as described by the press, the population of Brazil partially insulated and maintained, in part, physical contact with close individuals, including friends, neighbors and relatives, which may have favored the increase in cases of COVID-19 mainly in countryside cities. The advance of the pandemic in Brazil, from the state capitals to countryside cities is worrying, since the smaller cities have a smaller relative number of ICU beds, if present, in proportion to the total number of inhabitants. Additio-

nally, in these cities, the ability to process RT-PCRs for the SARS-CoV-2 virus is generally dependent on centers and/or laboratories located in other cities, which can lead to data loss and/or absence/diagnostic errors.

The serial assessment of adherence to social isolation with the increase in the number of cases, mainly in countryside cities and with the lowest number of inhabitants, may provide support for understanding about the progression of COVID-19 and the possibility of implementing local public health policies to stem the spread of the disease.

SARS index during pandemic COVID-19 compared to values obtained from epidemiological data from years prior to the pandemic

Table 2 shows the number of SARS cases between 2015 and 2020, as well as the average number of cases for 2015 to 2019. In the comparison between the values obtained in 2020 versus the mean of previous years, there seems to be an increase in the number of SARS cases in 2020, except for the state of Acre, where there was a decrease in the number of cases. Counting the total value of described cases higher than the mean of previous years, we have a total of 44 thousand cases that, possibly, can be elective to COVID-19 diagnosis and characterize in a high degree of underdiagnosis of the disease, superior to that described in literature.²²

The status of the regional indicators of the state of São Paulo for hospital capacity, evolution of the pandemic and decision-making as a model for addressing the economic factor in COVID-19 management

Due to the need for social isolation on March 16, 2020, through Decree 59.283, an emergency situation was declared in the municipality of São Paulo, with coping measures for the pandemic COVID-19, such as easing debts, prohibiting the operation of public and private institutions, such as museums and schools, in addition to not allowing the operation of events that needed agglomeration.¹² On June 9, 2020, Mayor Bruno Covas of the city of São Paulo instituted a protocol for resuming activities decreeing the resumption of essential activities for four hours a day, depending on the classification of the municipality's isolation phases and contamination rates instituted by the Government of São Paulo (Table 3).^{12,13}

The state government chose to direct the return of activities according to hospital capacity and the evolution of the pandemic. Both markers should and should be assessed in isolation and, subsequently, weighted in common. In an analysis of hospital capacity, two groups need to be assessed, namely the occupancy of ICU beds by patients with COVID-19 and the number of beds occupied by patients with COVID-19 per 100 thousand inhabitants. In an analysis of the evolution of the pandemic, three groups were assessed, all of which consider the variation of data between the periods. The selected markers were the number of cases, number of deaths and number of hospitalizations. The final score should and should be categorized into phases that allow modulation of face-to-face assistance, as described in table 4.

Table 2. Number of cases of severe acute respiratory syndrome described from 2015 to 2020.

States	2020	2019	2018	2017	2016	2015	Mean ^a	% referring to the period of 2020 ^b	Probable underreporting ^c
Acre	77	332	296	232	366	105	266.2	111.80	-34.80
Alagoas	166	231	204	23	139	1	119.6	50.23	115.77
Amapá	29	54	14	10	27	3	21.6	9.07	19.93
Amazonas	1,196	1,898	199	431	114	26	533.6	224.11	971.89
Bahia	1,475	1,682	1,796	532	1,002	287	1,059.8	445.12	1,029.88
Ceará	2,470	957	1,372	209	397	113	609.6	256.03	2,213.97
Federal District	1,055	2,095	1,353	722	627	129	985.2	413.78	641.22
Espírito Santo	426	674	606	363	724	67	486.8	204.46	221.54
Goiás	798	966	1,364	582	1,067	308	857.4	360.11	437.89
Maranhão	883	195	204	38	37	27	100.2	42.08	840.92
Mato Grosso	503	296	284	121	308	63	214.4	90.05	412.95
Mato Grosso do Sul	909	1,702	1,056	687	1,690	223	1,071.6	450.07	458.93
Minas Gerais	4,852	3,594	2,764	2,785	4,353	1,270	2,953.2	1,240.34	3,611.66
Pará	668	978	1,053	792	947	160	786	330.12	337.88
Paraíba	633	335	266	173	227	9	202	84.84	548.16
Paraná	3,990	6,366	5,777	3,730	5,721	2,215	4,761.8	1,999.96	1,990.04
Pernambuco	2,259	2,536	2,195	1,809	1,449	968	1,791.4	752.39	1,506.61
Piauí	718	438	498	171	201	29	267.4	112.31	605.69
Rio de Janeiro	5,131	2,072	1,577	938	2,053	471	1,422.2	597.32	4,533.68
Rio Grande do Norte	317	337	328	210	292	149	263.2	110.54	206.46
Rio Grande do Sul	2,635	3,097	3,257	2,795	4,837	2,128	3,222.8	1,353.58	1,281.42
Rondônia	77	145	89	35	148	40	91.4	38.39	38.61
Roraima	30	27	0	9	31	9	15.2	6.38	23.62
Santa Catarina	1,500	1,822	1,846	1,221	2,339	652	1,576	661.92	838.08
São Paulo	25,299	10,643	12,231	6,963	17,070	3,140	10,009.4	4,203.95	21,095.05
Sergipe	146	242	335	94	110	3	156.8	65.86	80.14
Tocantins	172	224	145	69	73	12	104.6	43.93	128.07
Total	58,414	43,938	41,109	25,744	46,349	12,607	33,949.4	14,258.75	44,155.25

^aMean was calculated for the period from 2015 to 2019 that preceded the beginning of the COVID-19 pandemic in Brazil; ^bValue referring to the period of 5 months of accounting for cases of severe acute respiratory syndrome for the mean calculated for the period from 2015 to 2019;

^cProbable underreporting of serious cases of COVID-19, which was calculated by the difference between the column (% referring to the period of 2020) and the column that reflects the number of cases in 2020.

Table 3. Status of São Paulo's regional indicators for hospital capacity, pandemic evolution, and decision-making.

RHD	Occupancy of COVID-19 ICU beds	COVID-19 beds/100 thousand inhab.	Health system capacity rating	Variation in cases	Variation in hospitalizations	Deaths variation	Classification for pandemic evolution	Final classification
State of São Paulo	69%	18.1		0.99	1.07	0.97		
01 Municipality of São Paulo	78%	31.6	Orange	0.80	0.98	0.84	Yellow	Orange
01 Great Northern São Paulo	78%	14.9	Orange	0.95	0.99	1.13	Yellow	Orange
01 Great Eastern São Paulo	74%	13.6	Orange	0.92	1.10	1.16	Orange	Orange
01 Great Western São Paulo	73%	13.9	Orange	1.03	0.97	0.87	Yellow	Orange
01 Great Southeastern São Paulo	68%	29.3	Yellow	1.25	0.97	1.63	Orange	Orange
01 Great Southwestern São Paulo	78%	9	Orange	0.82	0.94	0.50	Yellow	Orange
02 Araçatuba	24%	8.9	Green	1.62	1.31	2.25	Orange	Orange
03 Araraquara	34%	7.5	Green	1.38	1.21	1.50	Orange	Orange
04 Baixada Santista	70%	22.6	Orange	1.12	0.96	0.78	Orange	Orange
05 Barretos	27%	12.9	Green	1.07	1.93	2	Red	Red
06 Bauru	56%	7.3	Green	1.48	1.41	1.58	Orange	Orange
07 Campinas	69%	13.2	Green	1.42	1.36	1.24	Orange	Orange
08 Franca	48%	5.6	Green	0.84	1.07	1.33	Orange	Orange
09 Marília	21%	10.5	Green	1.17	1.29	3.50	Orange	Orange
10 Piracicaba	63%	8.4	Green	1.90	1.47	1.05	Orange	Orange
11 Presidente Prudente	52%	6	Green	1.76	1.60	1.50	Red	Red
12 Registro	31%	9.8	Green	1.35	0.86	2.00	Orange	Orange
13 Ribeirão Preto	60%	10.1	Green	1.75	1.51	2.00	Red	Red
14 São João da Boa Vista	24%	10.1	Green	0.62	1.06	2.50	Orange	Orange
15 São José do Rio Preto	34%	16.4	Green	1.74	1.20	2.00	Orange	Orange
16 Sorocaba	68%	7.1	Yellow	1.08	1.12	0.86	Orange	Orange
17 Taubaté	50%	11.9	Green	1.20	1.39	1.35	Orange	Orange
Classification by phase								
1 (red) - high alert	Over 80%	Below 3		Over 2	Over 1.5	Over 2		
2 (orange) - control	Between 70% and 80%	Between 3 and 5		Over 2	Between 1 and 1.5	Between 1 and 2		
3 (yellow) - loosening	Between 60% and 70%	Over 5		Between 1 and 2	Between 0.5 and 1	Between 0.5 and 1		
4 (green) - partial opening	Below 60%	Over 5		Below 1	Below 0.5	Below 0.5		

RHD - regional health district; ICU - Intensive Care Unit. Data referring to June 8, 2020. Data obtained from the São Paulo State Health Department.

Table 4. Modulation of face-to-face care through the phase of evolution of the COVID-19 pandemic and capacity of the health system.

Face-to-face service	Phase 1	Phase 2	Phase 3	Phase 4
Shopping center, galleries and similar establishments	No	Limited 20% capacity; Reduced hours (4 hours in a row); Prohibition of food courts; Adoption of industry-specific and standard protocols	Limited 40% capacity; Reduced hours (6 hours in a row); Prohibition of food courts (except outdoors); Adoption of industry-specific and standard protocols	
Commerce and services	No	Limited 20% capacity; Reduced hours (4 hours in a row); Adoption of industry-specific and standard protocols	Limited 40% capacity; Reduced hours (6 hours in a row); Adoption of industry-specific and standard protocols	Limited 60% capacity; Adoption of industry-specific and standard protocols
Local consumption (bars, restaurants and similar)	No	No	Outdoors only. Limited 40% capacity; Reduced hours (6 hours in a row); Adoption of industry-specific and standard protocols	Limited 60% capacity; Adoption of industry-specific and standard protocols
Beauty salons and barber shops	No	No	Limited 40% capacity; Reduced hours (6 hours in a row); Adoption of industry-specific and standard protocols	
Sports academies of all modalities	No	No	No	
Other activities that generate agglomeration	No	No	No	No

Data obtained from the São Paulo State Health Department; Decree 64,994 of May 28, 2020.

The resumption of economic activity is necessary. However, Brazil has an increase in the number of cases and deaths associated with COVID-19. At the moment, the number of deaths is close to 40 thousand. Using the state of São Paulo as an example, it is observed that the different regional health districts vary in terms of the capacity of the health system and the progression of the disease. However, all were classified within the orange and red bands, the most worrying fact being the increase in the progression of the disease and which can and could change the favorable overview of the health system's capacity for a collapse profile. In the general view, for the capacity of the health system, elective regions were observed for the return of activities, but, in the progression of the disease, the scenario was quite the opposite.

Data accounting and the importance of information management

During the beginning of COVID-19 pandemic, the Ministry of Health of Brazil progressively described the data obtained by the state health departments. In other words, each day, the value was added to the previous one, mainly for the number of cases, the number of deaths and the number of patients recovered. However, over a short period of time, there was a decision to change the presentation to report "only" the case numbers for the day of analysis. Due to an intervention by the judiciary, the Federal Government by the Ministry of Health had to return for the presentation of all cases.

Clearly, the totality of data makes it possible to understand the impact of the disease on the popula-

tion and the number of new cases and daily deaths to understand the disease progression. Thus, both data must be presented for the correct decision-making by the health authorities. Concomitantly, special attention must be paid to the daily accounting and overlapping of new cases and/or deaths that occurred on previous dates and that had the diagnosis by RT-PCR of the SARS-CoV-2 virus disclosed after patients' confirmed cure or death.

COVID-19 omission index

Although there are attempts to change the accounting for the reality and the credibility of the cases, there is incongruity between the data released by the Ministry of Health, in which updates and corrections of data have already been published. In addition, the official Ministry of Health website specific to COVID-19 was removed from the virtual environment in June.

In the process of updating data, for instance, Roraima had 762 registered deaths, however, after correcting the information, there were 172 deaths associated with COVID-19.⁹ Other errors were found after the data were released and led to less credibility of the information presented by the Federal Government of Brazil. However, despite the fact that Brazil is in a difficult time to deal with the pandemic COVID-19, the real situation is possibly much worse than what was announced. This fact can be seen by the sporadic and rapid increase in cases of SARS in 2020 and the need for hospitalization. If the approximately 40 thousand cases of SARS (5%) more than expected were described as being from patients with severe COVID-19, we would have at least 760 thousand

Table 5. Correlation of Spearman between the overview of infection by the SARS-CoV-2 virus, occupancy of Intensive Care Units (ICU), diagnostic tests and probable underreporting of serious cases of COVID-19

	Region	Cases	Death	Lethality	Incidence/ 100 thousand inhab.	Mortality/ 100 thousand inhab.	SARS/ COVID-19	SARS - other causes	SARS/ COVID-19	% ICU occupancy	RT-PCR	Underreporting
Cases	CC	0.930	0.930	0.508	0.389	0.603	0.534	0.467	-0.352	0.477	0.703	0.535
	P	<0.001	<0.001	0.007	0.045	0.001	0.004	0.014	0.078	0.014	<0.001	0.004
Deaths	CC	0.508		0.712	0.280	0.621	0.568	0.453	-0.428	0.473	0.631	0.535
	P	0.007		<0.001	0.158	0.001	0.002	0.018	0.029	0.015	<0.001	0.004
Lethality	CC	0.389	0.712		0.153	0.633	0.494	0.231	-0.575	0.238	0.330	0.284
	P	0.045	<0.001		0.445	<0.001	0.009	0.246	0.002	0.242	0.093	0.151
Incidence/100 thousand inhabitants	CC	0.603	0.280	0.153		0.829	-0.340	-0.475	-0.289	0.555	0.298	-0.396
	P	0.001	0.158	0.445		<0.001	0.083	0.012	0.152	0.003	0.131	0.041
Mortality/100 thousand inhabitants	CC	0.534	0.621	0.633	0.829		0.045	-0.184	-0.559	0.562	0.350	-0.106
	P	0.004	0.001	<0.001	<0.001		0.822	0.359	0.003	0.003	0.073	0.600
SARS by COVID-19	CC	0.467	0.568	0.494	-0.340	0.045		0.885	-0.469	-0.076	0.424	0.880
	P	0.014	0.002	0.009	0.083	0.822		<0.001	0.016	0.711	0.028	<0.001
SARS for other causes	CC	-0.352	0.453	0.231	-0.475	-0.184	0.885		-0.052	-0.199	0.390	0.978
	P	0.078	0.018	0.246	0.012	0.359	<0.001		0.800	0.329	0.044	<0.001
SARS/COVID-19	CC	0.477	-0.428	-0.575	-0.289	-0.559	-0.469	-0.052		-0.315	-0.086	-0.063
	P	0.014	0.029	0.002	0.152	0.003	0.016	0.800		0.125	0.674	0.759
% ICU occupancy	CC	0.703	0.473	0.238	0.555	0.562	-0.076	-0.199	-0.315		0.176	-0.142
	P	<0.001	0.015	0.242	0.003	0.003	0.711	0.329	0.125		0.390	0.488
RT-PCR	CC	0.535	0.631	0.330	0.298	0.350	0.424	0.390	-0.086	0.176		0.461
	P		<0.001	0.093	0.131	0.073	0.028	0.044	0.674	0.390		0.016
Underreporting	CC		0.535	0.284	-0.396	-0.106	0.880	0.978	-0.063	-0.142	0.461	
	P		0.004	0.151	0.041	0.600	<0.001	<0.001	0.759	0.488	0.016	

ARS - severe acute respiratory syndrome; RT-PCR - real time-polymerase chain reaction for the SARS-CoV-2 virus; % - percentage; CC - correlation coefficient; P - p-value. Data with a significant p-value are shown in bold. Statistical analysis was performed using Spearman's correlation test. Alpha of 0.05 was adopted for all statistical analyzes.

(95%) other individuals infected with SARS-CoV-2 and without diagnosis.

In Brazil, two additional factors draw attention to the progression of the pandemic, namely: (a) a high number of health professionals who were infected with SARS-CoV-2, mainly nurses, in relation to the number of cases by specialty in comparison with international values;²³ (b) low availability of ICUs in the period before the start of the pandemic.²⁴

Number of cases and deaths reported by the Ministry of Health and the media consortium (G1, O Globo, Extra, Estadão, Folha, and UOL)

As described in the topic on the omission index on COVID-19, Brazil failed to present epidemiological data for a short period of time, and after that period, the data were presented according to the daily findings. Thus, some national press vehicles

opted for the acquisition of the data together with the state health departments. Some divergences were observed regarding the number of cases and deaths between both surveys using the same sources of information. Inconsistencies need to be better assessed so that we can have a greater degree of reliability in the data presented by the federal government for COVID-19 pandemic.

Concern with minority groups

In Brazil, the situation is worrying for two groups in particular: (a) slum residents; (b) indigenous population. Both populations have restricted access to health services and, possibly, a high degree of underdiagnosis of COVID-19. Despite widespread publicity in the media, in Brazil, for both scenarios, government measures to contain the

the populations of residents in the favelas, information on the progression of COVID-19 is extremely scarce; however, an increase in the number of deaths has been documented, mainly in homes and actions by members of the community itself to contain the pandemic.

Correlation between the markers assessed in the study despite the COVID-19 pandemic

In the study carried out, numerous correlations were positive, as shown in Table 5, with emphasis on the following correlations:

- (a) number of cases of COVID-19 with the percentage of ICU occupancy [correlation coefficient (CC) = 0.577], the number of RT-PCRs of the SARS-CoV-2 virus performed (CC = 0.703) and the probable underreporting (CC = 0.535);
- (b) number of deaths associated with COVID-19 with the ratio between SARS and SARS by COVID-19 (CC = -0.428), the percentage of ICU occupancy (CC = 0.473), the number of RT-PCRs from the SARS virus -CoV-2 performed (CC = 0.631) and the probable underreporting of COVID-19 (CC = 0.535);
- (c) lethality by COVID-19 with the ratio between SARS and SARS by COVID-19 (CC = -0.575);
- (d) incidence of COVID-19 per 100 thousand inhabitants with the ratio between SARS and SARS by COVID-19 (CC = -0.475), ICU occupancy percentage (CC = 0.555) and probable underreporting of COVID-19 (CC = -0.396);
- (e) mortality of COVID-19 per 100 thousand inhabitants with the number of cases of COVID-19 (CC = 0.603), incidence of COVID-19 per 100 thousand inhabitants (CC = 0.821), ratio between SARS and SARS by COVID-19 (CC = -0.559) and the percentage of ICU occupancy (CC = 0.562);
- (f) probable underreporting by COVID-19 with the number of tests performed for RT-PCRs of the SARS-CoV-2 virus (CC = 0.461).

In conclusion, epidemiological data, mainly referring to the number of new cases, deaths and hospitalizations associated with COVID-19 and analysis of adherence to social isolation and the overview of health services, are extremely important to enable decision-making by part of health managers and government, mainly federal.

However, in Brazil, access to information that characterizes the reality of the moment in which we live before the pandemic COVID-19 has been limited and we need to optimize the RT-PCR diagnosis of the SARS-CoV-2 virus, especially in asymptomatic cases and mild infections of individuals colonized by the virus. A better structuring of the information system of COVID-19 in Brazil, by the Ministry of Health, should be carried out in order to promote a detailed description of the evolution of the disease on a national basis.

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