

COVID-19 and hospitalizations for SARI in Brazil: a comparison up to the 12th epidemiological week of 2020

COVID-19 e hospitalizações por SRAG no Brasil: uma comparação até a 12ª semana epidemiológica de 2020

COVID-19 y las hospitalizaciones por el SRAG en Brasil: una comparación hasta la 12ª semana epidemiológica de 2020

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Abstract

Surveillance of the severe acute respiratory illness (SARI) in Brazil aims to characterize the circulation of the Influenza A and B viruses in hospitalized cases and deaths, having been expanded in 2012 to include other respiratory viruses. COVID-19 was detected in Brazil for the time in the 9th epidemiological week of 2020, and the test for the SARS-CoV-2 virus was included in the surveillance protocol starting in the 12th epidemiological week. This study's objective was to investigate the pattern of hospitalizations for SARI in Brazil since the entry of SARS-CoV-2, comparing the temporal and age profiles and laboratory results to the years 2010 through 2019. In 2020, hospitalizations for SARI, compiled from the date of the first confirmed case of COVID-19 up to the 12th week, exceeded the numbers observed during the same period in each of the previous 10 years. The age bracket over 60 years was the most heavily affected, at higher than historical levels. There was a considerable increase in negative laboratory tests, suggesting circulation of a different virus from those already present in the panel. We concluded that the increase in hospitalizations for SARI, the lack of specific information on the etiological agent, and the predominance of cases among the elderly during the same period in which there was an increase in the number of new cases of COVID-19 are all consistent with the hypothesis that severe cases of COVID-19 are already being detected by SARI surveillance, placing an overload on the health system. The inclusion of testing for SARS-CoV-2 in the SARI surveillance protocol and the test's effective nationwide deployment are extremely important for monitoring the evolution of severe COVID-19 cases in Brazil.

Severe Acute Respiratory Illness; Coronavirus Infections; Epidemiologic Surveillance

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Introduction

In Brazil, reporting of hospitalized cases of severe acute respiratory illness (SARI) has been done in the Information System on Diseases of Notification (SINAN) since the Influenza A (H1N1) pandemic in 2009¹. Initially, the surveillance protocol for SARI focused on identifying the hospitalized cases and deaths related to the Influenza A and B viruses, and since 2012 it has also included respiratory syncytial virus (RSV), Adenovirus, and Parainfluenza 1, 2, and 3^{1,2}. With the arrival of COVID-19 and the detection of community transmission in Brazil, the protocol has also included the test for SARS-CoV-2, starting in the 12th epidemiological week³.

RT-PCR testing for SARS-CoV-2 in SARI surveillance has been introduced in Brazil in the midst of growing spread of this virus in the country and challenges for the pandemic's containment and mitigation³. In this context, the study aims to assess whether the entry of SARS-CoV-2 in Brazil altered the pattern of hospitalizations for SARI. In particular, the study compares the evolution in the number of confirmed cases of COVID-19 and SARI cases from the 9th to the 12th epidemiological weeks of 2020 and the hospitalization rates for SARI from 2010 to 2020, stratified by age bracket and the results of laboratory tests for the identification of respiratory viruses. The hypothesis is that the novel virus is already being observed as a cause of SARI in 2020, even before laboratory confirmation of these cases.

Methods

Data

• COVID-19

Due to the necessary readjustment of the country's protocols and information system, new cases of COVID-19 were not available publicly in the system, but rather in epidemiological reports and bulletins produced by State Health Departments and the Brazilian Ministry of Health. In this context, the cases recorded from the 9th epidemiological week of 2020 (when the first case was confirmed) through the 12th week were collected by two independent data aggregators. The first aggregator was developed by Wesley Cota⁵ and made available at the website <https://labs.wesleycota.com/sarscov2/br/> and will be referred to here as "COVID-19 (WC)". The second was developed by Álvaro Justen et al. and made available at the website <https://Brazil.io/dataset/covid19/boletim> and will be called "COVID-19 (AJ et al.)".

• SARI

The following are defined as SARI cases and are subject to compulsory notification, namely individuals with a combination of the following symptoms⁶:

- (i) High fever (> 37.8°C) AND
- (ii) Cough OR sore throat AND
- (iii) Difficulty breathing OR dyspnea OR O₂ saturation < 95% AND
- (iv) Required hospitalization OR evolved to death having presented the symptoms above, regardless of hospitalization.

The numbers of new cases of hospitalization for SARI in Brazil by age bracket and year from 2010 through 2020, from the 9th to the 12th epidemiological weeks of each year, as well as the results of laboratory tests performed in these patients, were extracted from SINAN and the Influenza Surveillance System (SIVEP/Gripe), which replaced SINAN for notification of SARI beginning in 2019. The predicted count of SARI cases for the above-mentioned weeks was extracted from the Infogripe system (<http://info.gripe.fiocruz.br>), which uses a Bayesian statistical method to correct for reporting delay⁷. This method is used in routine influenza surveillance, according to the contingency plan established by the Brazilian Ministry of Health⁸. The Infogripe system is the result of a partnership between the Brazilian Ministry of Health, the Scientific Computing Program of the Oswaldo Cruz

Foundation (<http://www.procc.fiocruz.br>), and the School of Applied Mathematics of the Getúlio Vargas Foundation (<https://emap.fgv.br/>).

The SARI data used here were inserted into the system up to March 21st, the last day of the 12th epidemiological week.

Analyses

We calculated the absolute numbers of new COVID-19 cases per epidemiological week for the year 2020 and of hospitalizations due to SARI for the years 2010 through 2020, stratified by age brackets. To assess the effect of the entry of COVID-19 in Brazil on notifications of hospitalizations due to SARI, a descriptive analysis was performed in the R software, version 3.6.3 (<http://www.r-project.org>).

Results

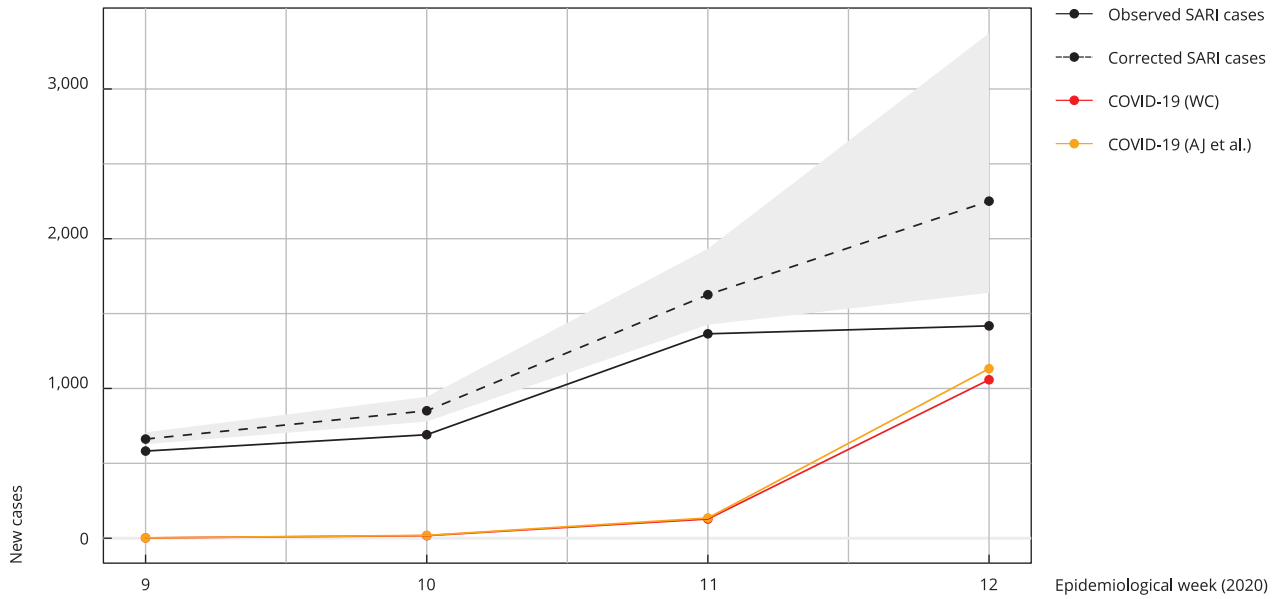
COVID-19 was reported for the first time in Brazil in the 9th epidemiological week of 2020, totaling two cases. Figure 1 shows the evolution in the number of cases starting that week until the 12th epidemiological week. During that period there was an upward trend in the rate of COVID-19 notifications, surpassing 100 cases in the 11th epidemiological week and 1,000 cases in the 12th week. The hospitalization rate due to SARI also showed an upward trend during the same period, with the number of cases in the 11th epidemiological week ($n = 1,365$) having doubled that of the previous week ($n = 691$). For comparison, the historical median in non-epidemic years was 266 SARI hospitalizations in the 11th week and 299 in the 12th week. According to the estimate for SARI with correction for reporting delay, the real occurrence of hospitalizations for SARI in the 12th week is actually 59% higher than reported thus far. Using this correction, there was an observed increase in SARI, concurrently with the arrival of COVID-19 (Figure 1).

The years with the most hospitalizations for SARI were 2010, 2016, 2019, and 2020 (with $n = 1,826$, $n = 3,821$, $n = 3,305$, and $n = 4,056$ hospitalizations, respectively). These values are higher than the mean value in the other years, considering the same time period ($n = 951.3$ hospitalizations/year). Figure 2 shows the hospitalizations for SARI from the 9th to 12th epidemiological weeks for the years 2010 through 2020, stratified by age bracket. Age stratification shows that the 0 to 2-year age bracket had the highest proportion of hospitalizations every year except 2020, when the highest proportion was in individuals 60 years or older (26.7%).

Figure 3 shows the proportions of laboratory test results for the respiratory viruses in the panel, namely Influenza A and B, Parainfluenza types 1, 2, and 3, RSV, and Adenovirus among the hospitalized cases of SARI from the 9th to the 12th epidemiological weeks in the years 2010 through 2020. From 2010 e 2018, between 50% and 70% of the tests performed were negative for the tested viruses, while in 2019 and 2020, the proportions of negative tests increased to 72.1% and 94.5%, respectively. In the years with the most hospitalizations for SARI (2010, 2016, 2019, and 2020), Influenza A virus was detected in 12.5%, 34.5%, 4.9%, and 2.8% of the SARI cases, respectively. In 2019, RSV was detected in 23.3% of the cases, while Influenza B, the Parainfluenza viruses, and Adenovirus were detected at most in 3%, 2%, and 1% of the SARI cases, respectively, in the years analyzed.

Figure 1

Absolute numbers of confirmed COVID-19 cases using two data aggregators (solid red and orange lines), hospitalizations for severe acute respiratory illness – SARI (solid black line), and hospitalizations for SARI with correction for reporting delay (dotted line) and 95% confidence intervals (95%CI) for Brazil in 2020, according to epidemiological week.



COVID-19 (AJ et al.): aggregator developed by Álvaro Justen et al. (<https://Brazil.io/dataset/covid19/boletim>); COVID-19 (WC): aggregator developed by Wesley Cota (<https://labs.wesleycota.com/sarscov2/br/>).

Figure 2

Absolute numbers of cases of hospitalizations for severe acute respiratory illness (SARI) in Brazil from the 9th to 12th epidemiological weeks in years 2010 through 2020, stratified by age brackets.

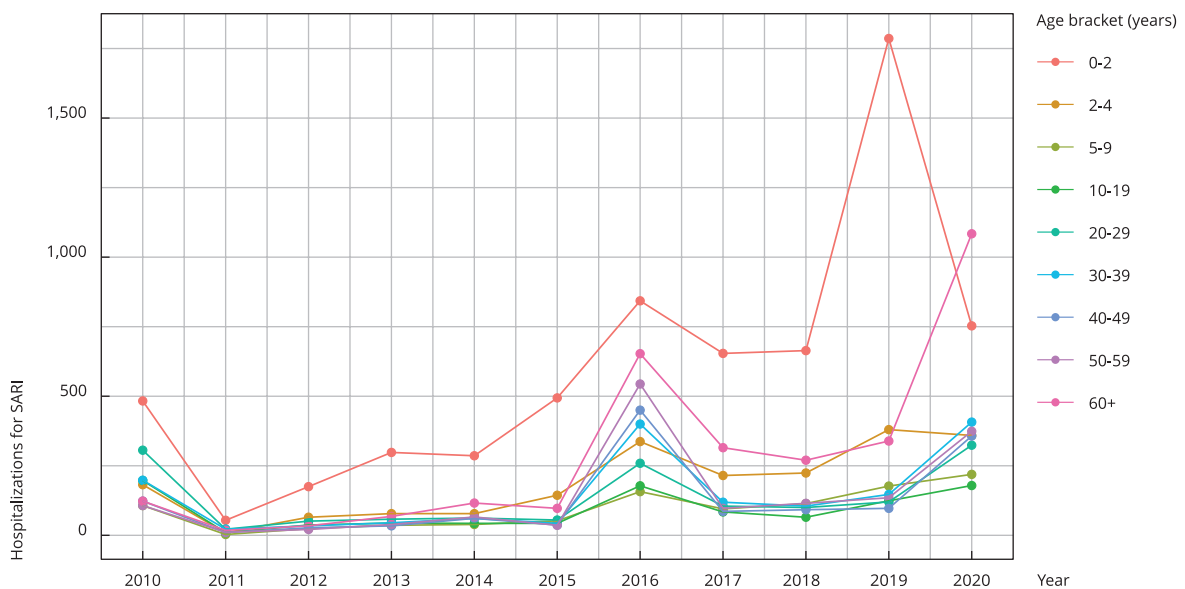
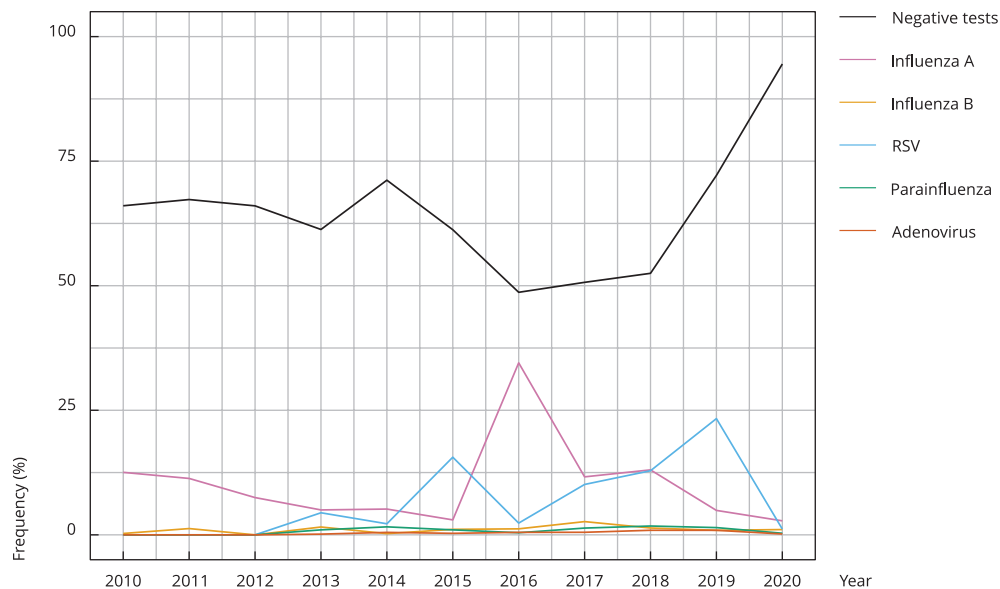


Figure 3

Proportions of laboratory test results for identification of Influenza A and B, Parainfluenza (types 1, 2, and 3), respiratory syncytial virus (RSV), and Adenovirus, among cases of hospitalization for severe acute respiratory illness (SARI) in Brazil from the 9th to 12th epidemiological weeks in the years 2010 through 2020.



Discussion

In 2020, hospitalizations for SARI since the detection of the first case of COVID-19 in Brazil exceeded those observed in the same period in each of the previous 10 years, even considering the known reporting delay. The increase in hospitalizations for SARI in 2020, the lack of specific information on the hospitalizations' etiological agent, and the predominance of cases in the elderly during the same period in which there was an increase in new COVID-19 cases is consistent with the hypothesis that COVID-19 is being detected by the SARI surveillance system, although it is not possible to prove this due to the lack of specific testing. In this case, the hospitalization of severe cases of COVID-19 are already creating an overload on the health system.

The high rate of negative laboratory test results in SARI surveillance is noteworthy, both historically and specifically in 2020. It is possible that part of this difficulty in obtaining positive results is due to problems with the quality of the collected samples, inappropriate handling, or processing delay². However, one cannot rule out the possible circulation of other etiological agents, different from those previously tested. Over the years, the composition of the test panel has been modified to widen the scope of surveillance, although it has always prioritized Influenza virus⁸. The proportion of negative test results reached 91% in 2020, an unprecedented level.

The risk factors for hospitalization due to COVID-19 are age greater than 60 years and presence of comorbidities such as hypertension, diabetes, heart disease, and respiratory disease⁹. This was the age bracket with the most hospitalizations for SARI in 2020.

The year 2019 was also atypical in terms of hospitalization for SARI. More than half of the cases that year occurred in children under two years of age, and the most frequently detected virus was RSV (23.3%). RSV has shown similar seasonality to that of Influenza in Brazil and has been identified worldwide as the most common cause of acute respiratory infections in children, although it also causes respiratory disease in other age groups, especially in the elderly and adults with comorbidities¹⁰.

COVID-19 arrived in Brazil during the season of the year in which respiratory virus activity is generally low. Only in 2010 and 2016, SARI seasonality occurred earlier (in the late summer and autumn) in most of Brazil's states ¹¹, with a predominance of Influenza A virus. The increase in hospitalizations for SARI so early in 2020 calls our attention, since there is an upward tendency in SARI cases between the autumn and winter, especially in higher-latitude states ¹¹. In this scenario, it is worrisome that the persistence of the COVID-19 pandemic, alongside peaks in Influenza infections, may further overload the health system in the coming months, which justifies having anticipated the Influenza vaccination campaign in the country in 2020.

The hypothesis that the increase in the number of COVID-19 cases in Brazil is already revealing its importance as a cause of SARI in 2020 is consistent with the change in the profile of hospitalizations. Proof of the hypothesis requires the inclusion of SARS-CoV-2 testing in the SARI surveillance protocol and its effective nationwide implementation.

Contributors

L. S. Bastos contributed to the study's conception, data collection and processing, analysis, and writing and critical revision of the text. R. P. Niquini contributed to the study's conception, analysis, and writing and critical revision of the text. R. M. Lana, D. A. M. Villela, O. G. Cruz, F. C. Coelho, and C. T. Codeço contributed to the writing and critical revision of the text. M. F. C. Gomes contributed to the data collection and processing and writing and critical revision of the text.

Additional informations

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Resumo

A vigilância de síndrome respiratória aguda grave (SRAG) no Brasil visa a caracterizar a circulação dos vírus Influenza A e B em casos hospitalizados e óbitos, tendo sido ampliada em 2012 para incluir outros vírus respiratórios. A COVID-19 foi detectada no Brasil pela primeira vez na 9ª semana epidemiológica de 2020 e o teste para o vírus SARS-CoV-2 foi incluído no protocolo de vigilância a partir da 12ª semana epidemiológica. O objetivo deste estudo foi investigar o padrão de hospitalizações por SRAG no país após a entrada do SARS-CoV-2, comparando o perfil temporal, etário e de resultados laboratoriais com os anos de 2010 a 2019. Em 2020, a hospitalização por SRAG, contabilizada desde a data do primeiro caso de COVID-19 confirmado até a 12ª semana, superou o observado, no mesmo período, em cada um dos 10 anos anteriores. A faixa etária acima de 60 anos foi a mais acometida, em nível acima do histórico. Houve um aumento considerável de testes laboratoriais negativos, sugerindo a circulação de um vírus diferente dos presentes no painel. Concluímos que o aumento das hospitalizações por SRAG, a falta de informação específica sobre o agente etiológico e a predominância de casos entre idosos, no mesmo período de tempo em que cresce o número de casos novos de COVID-19, é coerente com a hipótese de que os casos graves da doença já estejam sendo detectados pela vigilância de SRAG com sobrecarga para o sistema de saúde. A inclusão da testagem para SARS-CoV-2 no protocolo de vigilância de SRAG e sua efetiva implementação são de grande importância para acompanhar a evolução dos casos graves da doença no país.

Síndrome Respiratória Aguda Grave; Infecções por Coronavírus; Vigilância Epidemiológica

Resumen

La vigilancia del síndrome respiratorio agudo grave (SRAG) en Brasil tiene como objetivo caracterizar la circulación de los virus de la Influenza A y B en casos y muertes hospitalizadas, y se expandió en 2012 para incluir otros virus respiratorios. La COVID-19 se detectó en Brasil por la primera vez en la 9ª semana epidemiológica de 2020, y el examen test para el virus SARS-CoV-2 se incluyó en el protocolo de vigilancia a partir de la 12ª semana epidemiológica. El objetivo de este estudio fue investigar el patrón de hospitalizaciones por SRAG en Brasil desde la entrada de SARS-CoV-2, comparando el perfil temporal y de edad y los resultados de laboratorio entre los años 2010 a 2019. En 2020, las hospitalizaciones por SRAG, compiladas a partir de la fecha del primer caso confirmado de COVID-19 hasta la 12ª semana, excedió los números observados durante el mismo período en cada uno de los 10 años anteriores. El grupo de edad mayor de 60 años fue el más afectado, a niveles superiores a los históricos. Hubo un aumento considerable en las pruebas de laboratorio negativas, lo que sugiere la circulación de un virus diferente de los que ya están presentes en el panel. Se concluye que el aumento de las hospitalizaciones por SRAG, la falta de información específica sobre el agente etiológico y el predominio de casos entre los ancianos en el mismo período en que hubo un aumento de casos nuevos de COVID-19 se entiende que con esta hipótesis de que los casos graves de COVID-19 ya estén siendo monitorados por la vigilancia de SRAG, lo que genera una sobrecarga en el sistema de salud. La inclusión de los exámenes para SARS-CoV-2 en el protocolo de vigilancia de SRAG y la eficacia de implementación son de grande importancia para monitorear la evolución de los casos graves de COVID-19 en Brasil.

Síndrome Respiratorio Agudo Grave; Infecciones por Coronavírus; Vigilancia Epidemiológica

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