

Change in the pattern of respiratory viruses identified in a pediatric population hospitalized during the years of 2019 and 2020

Mudança no padrão de vírus respiratórios identificados em uma população pediátrica hospitalizada durante os anos de 2019 e 2020

Eliza Lavall Bamberg¹; Rafaela Lima Nogueira¹; Dayra Aparecida de Almeida Pinheiro¹; Camila Magalhães Silva¹; Silvia Paschoalini^{1,2}

ABSTRACT

Introduction: highlighted as an etiological agent in several respiratory diseases, viruses, has great importance in Pediatric Pulmonology. **Objective:** study the viruses identified from respiratory secretions of pediatric patients hospitalized in the pediatric ward and ICU, during the period from January 2019 to December 2020. **Methodology:** survey of results of the RT-PCR (reverse transcriptase reaction followed by polymerase chain reaction) of respiratory secretions of pediatric patients, through the LAM (Laboratory Analysis Management) applying the necessary filters to select the patients of the institution and the stipulated period. **Results:** Thirty collections were performed in 2019 and 196 in 2020 for respiratory secretions due to the Respiratory Syndrome. The samples collected in 2019 were positive for viruses in 56.7% of the investigated cases, with 6.7% for Influenza and 50% for Respiratory Syncytial Virus (RSV), while in 2020 the samples were positive in 21.4% of the cases, all of which were for SARS-Cov-2. The period of the year with the highest number of secretion collections was in May and June considering 2019 (60% of 2019 collections), and July, August and December considering 2020 (42.8% of 2020 collections), with a positivity of 77.7% (2019) and 25% (2020) for viruses requested for research. **Conclusion:** It was possible to notice an important change in the profile of the viruses identified in respiratory conditions between 2019 and 2020, comparable to the profile presented by the Epidemiological Bulletins of the Ministry of Health, especially in the year 2020 with the emergence of the new coronavirus and its pandemic. The viral etiology present in the vast majority of pediatric respiratory conditions should always be valued and viral identification tests are tools of great applicability in the clinic.

Keywords: Viral Panel, Respiratory Viruses, Pediatrics

RESUMO

Introdução: de destaque como agente etiológico em várias doenças respiratórias, os vírus, tem grande importância dentro da Pneumologia Pediátrica. **Objetivo:** estudar os vírus identificados de secreções respiratórias de pacientes pediátricos, hospitalizados na enfermaria e UTI pediátrica, durante o período de janeiro de 2019 a dezembro de 2020. **Metodologia:** levantamento de resultados do RT-PCR (reação da transcriptase reversa seguida pela reação em cadeia da polimerase) de secreções respiratórias de pacientes pediátricos, através do GAL (Gerenciamento de Análises Laboratoriais) aplicando os filtros necessários para selecionar os pacientes da instituição e o período estipulado. **Resultados:** Foram realizadas 30 coletas em 2019 e 196 em 2020 de secreções respiratórias devido ao quadro de Síndrome Respiratória. As amostras coletadas em 2019 foram positivas para vírus em 56,7% dos casos investigados, sendo 6,7% para Influenza e 50% para Vírus Sincicial Respiratório (VSR), enquanto que em 2020 as amostras foram positivas em 21,4% dos casos, sendo todos eles para SARS-CoV-2. O período do ano com maior número de coletas de secreção foi em maio e junho considerando o ano de 2019 (60% das coletas de 2019), e julho, agosto e dezembro considerando o ano de 2020 (42,8% das coletas de 2020), com uma positividade de 77,7% (2019) e 25% (2020) para os vírus solicitados para pesquisa. **Conclusão:** Pôde-se perceber uma importante mudança no perfil dos vírus identificados dos quadros respiratórios entre 2019 e 2020, comparáveis ao perfil apresentado pelos Boletins Epidemiológicos do Ministério da Saúde, principalmente no ano de 2020 com o surgimento do novo coronavírus e sua pandemia. A etiologia viral presente na grande maioria dos quadros respiratórios da pediatria, deve sempre ser valorizada e os testes de identificação viral são ferramentas de grande aplicabilidade na clínica.

Palavras-chave: PAINEL VIRAL; Vírus Respiratórios; Pediatria

¹ Hospital Regional João Penido/FHE-MIG. Juiz de Fora – MG. Brasil .

² Universidade Federal de Minas Gerais/UFMG. Belo Horizonte - MG. Brasil.

Editor Associado Responsável:

Alexandre Moura

Autor Correspondente:

Eliza Lavall Bamberg

E-mail: lilavall@hotmail.com

Conflito de Interesse:

Não há.

Recebido em: 20/07/2021.

Aprovado em: 05/09/2021.

Data de Publicação: 11/22/2021

DOI: 10.5935/2238-3182.2021e31112

INTRODUCTION

Respiratory diseases in pediatrics have a high prevalence, such as RSV, which leads to the death of 200,000 children with around 3 million visits worldwide, and generates a significant economic impact, especially in the context of public health. They are also responsible for 26 million absences from school a year. Therefore, the pathological involvement of the airways in pediatrics has viruses as the main etiological agents, and knowing their incidence in the population served at our institution to support a more appropriate treatment, with rational use of antibiotics, is an incentive for the proper management of viral infections mainly in risk groups.

Diseases caused by viruses are responsible for various types of clinical presentation, evolution and severity, depending on various factors such as age, prematurity, among others, observed during the SARS-CoV-2 pandemic that we are facing with clinical cases of respiratory conditions and different evolutions.^{1,2,3,4,5}

In addition, the distribution of the various viruses in our country follows a seasonality that is observed in all years, except in the year 2020, in which we had an important change in this viral profile due to the new coronavirus⁶. Thus, it is important to know the viral panel observed outside the pandemic period and its clinical manifestations, and to compare them to the period in which we were exposed to the SARS-Cov2 pandemic.²

Up to the Epidemiological Week 49 of 2019 (December 2019) 39,190 cases of SARS were reported, 81.8% (32,048 / 39,190) with processed sample and with results inserted in the system. Of these, 17.8% (5,714 / 32,048) were classified as SARS due to influenza and 23.6% (7,556 / 32,048) as other respiratory viruses. Among the cases of influenza, 59.5% (3,399 / 5,714) were influenza A (H1N1) pdm09; 13.5% (772 / 5,714) influenza A not subtyped; 12.1% (694 / 5,714) influenza B and 14.9% (849 / 5,714) influenza A (H3N2). Among the other respiratory viruses surveyed (Respiratory Syncytial Virus, Parainfluenza and Adenovirus), 69.9% (5,283 / 7,556) of the cases identified the Respiratory Syncytial Virus.²

Of the total of 954,092 hospitalized SARS cases with onset of symptoms between epidemiological week 01 and 48 (November 2020), 54.3% (517,800) were confirmed for COVID-19; 35.6% (339,535) for unspecified SARS; 9.2% (87,647) are under investigation; 0.3% (2,649) were caused by influenza; 0.4% (3,930) for other respiratory viruses and 0.3% (2,531) for other etiologic agents.³

During the COVID-19 pandemic, there was a clear change in the profile of the pediatric hospitalized patient in our Institution - Hospital Regional João Penido -, and of the etiological agents that were identified, which motivated the present study. The objective of this study was to describe the panel of the viruses identified in the period from 2019 to 2020, through RT-PCR of respiratory secretions of pediatric patients hospitalized in the pediatric ward and ICU of the Hospital Regional João Penido.

METHODOLOGY

A cross-sectional study was carried out, with data collection, regarding the results of RT-PCR of respiratory secretions through the Laboratory Environment Manager (LAM) applying the

necessary filters in the period from January 2019 to December 2020.⁷

Given the high sensitivity and specificity in identifying the pathogen, the test above diagnoses the disease by detecting the virus genome through the reaction in reverse transcriptase polymerase chain in the sample examined via nasopharyngeal swabs, oropharynx or tracheal aspirate depending on the age and clinical conditions of the patient, collected in viral transport means, conditioned at a temperature of 35.6 to 46.4°F and sent to the responsible laboratories. In the first step of the analytical phase, the sample is subjected to extraction of the genetic material. This extracted material is then added to a plate containing specific reagents for virus detection, subjected to temperature change in shape cyclic, repeated. During this process, if the sample shows the presence of genetic material viral (ARN), this will be multiplied millions of times until detected by fluorimetry. The training and care of the team in the acquisition of material are essential for the presentation of the results.

The target of the research was children hospitalized in the Infirmary and in the ICU

Pediatrics at the Hospital Regional João Penido in Juiz de Fora - MG, and the criteria for collection was hospitalization with a diagnosis of any respiratory disease and/or suspected contact with a case suspected SARS-CoV-2 infection. It was not included at this time of the study evaluation of vaccine card data.

The work was approved by the Ethics and Research Committee of FHEMIG and Plataforma Brasil, according to opinion No. 4.694.804. The data collected underwent univariate analysis and the percentages found were described in the course of the present study.

RESULTS

In the survey of the data collected in the LAM, it is observed that of the 30 RT-PCR exams performed in 2019, 15 (50%) were Respiratory Syncytial Virus, 2 (6.7%) were Influenza (1 Influenza A H1N1 and 1 seasonal Influenza A H3) and in 13 (43.3%) patients, the RT-PCR for viruses was not identified. The RSV has been present since January 2019, showing a higher incidence in the months of May and June of 2019. In addition to the reduced number of exams requested throughout the year 2019 it is observed that the most hospitalized age group in pediatric ICU and ward for respiratory disease is below 2 years of life, 73% is less than 24 months old, 16% has between 2 and 4 years old, 10% over 4 years old. Considering that the 2019 collections took place in children between 9 days old and up to 7 years old (Graph 1).

In 2020, 196 tests were collected in patients aged between 1 day of life and 13 years old, with about 42% being less than or equal to 2 years old. Thus, there is a change in the age group of children admitted to the service in the year the COVID-19 pandemic began. When performing the RT-PCR for virus identification in patients with respiratory conditions, it was observed that 42 tests (21.4%) were positive for SARS-CoV-2 and in 154 (78.6%) the RT-PCR for this virus was not identified, however in only 2.5% of the cases research was carried out for other respiratory viruses. It is noteworthy the much higher number of requests for tests for viral identification that was observed in 2020 (196 tests) compared to the year 2019 (30 tests) and the participation of another agent (SARS-CoV-2) that was not part of our viral panel before. This, in turn, began its presentation in April

2020, increasing the number of cases increasing with peaks in June, July, September and December 2020 (Graph 2).

DISCUSSION

It was possible to notice an important change in the profile of the viruses identified in the respiratory conditions in the studied period, where it is observed that in 2019 we had distributed the most common viruses in our population, such as RSV and Influenza. With the SARS-Cov2 Pandemic in 2020, the panel of identified agents was changed by several aspects that will be discussed.

In the study carried out in 2019, 50% of the samples were positive for RSV and 6.7% were positive for Influenza, which could also be observed with the data presented by the Ministry of Health until Epidemiological Week 49 of 2019 (Dec 2019) when 5,714 cases classified as SARS due to influenza and 7,556 cases as other respiratory viruses, such as Respiratory Syncytial Virus, Parainfluenza and Adenovirus, were showing the predominance of the two types of viruses found in our sample.²

Compared to the 2019 data, it is observed that there was an increase in the number of RT-PCR tests performed in 2020 for viral identification by more than 653% (30x196) in patients with respiratory conditions, and of these, 21.4% were positive for SARS -CoV-2, the others were not identified which etiological agent was involved because in only 2.5% of the patients PCR was collected to search for other viruses. Due to the pandemic and the focus on SARS-COV2 infection, the collections were directed towards this etiological agent and, many times, it was not the causative agent of the respiratory condition at the time. Thus, the ideal time for collecting material for researching other viruses was lost, and in these situations the children were left without the identification of another possible viral agent involved in the respiratory condition.

Assessing the literature data and the Ministry of Health Epidemiological Bulletins available between epidemiological week 01 and 48 (Nov 2020), 54.3% cases were confirmed for SARS-CoV-2, 35.6% for Severe Acute Respiratory Syndrome (SARS) unspecified, 9.2% are under investigation, 0.3% were caused by influenza, 0.4% by other respiratory viruses and 0.3% by other etiological agents³. Thus, it is observed that there was also a reduction in the number of circulating viruses, with SARS-CoV-2 being the predominant one at this time. According to the Ministry of

Health, in 2020, hospitalizations for COVID-19 in children and adolescents aged 0 to 19 years (age groups that represent more than 25% of our population) represented 2.46% of total hospitalizations (14,638/594,587) and 0.62% of all deaths (1,203/191,552)⁸.

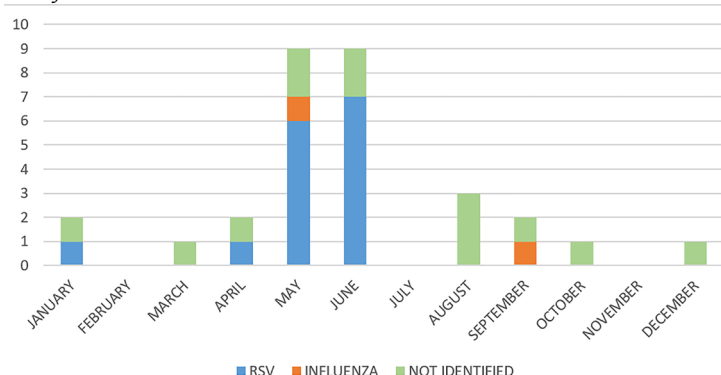
The difficulties sometimes observed in the availability of the resource, in the collection process, sending the material and in a timely manner for its stability, became an obstacle to the use of an important resource in the propaedeutics of respiratory diseases, generating an impact as in the process of using adequate personal protective equipments and release of isolation beds, which led our epidemiological knowledge to be guided by the data presented by the Ministry of Health reports and available in the literature. Sometimes, the possibility of co-infection has not been raised and as the pandemic progressed and the difficulties in processing these tests happened, tests related to SARS-CoV-2 were given priority.

The Manual of the Management Committee of Laboratory Resources (CGLAB) / National Center of Epidemiology (CENEPI) describes the appropriate procedures for collecting, transporting, processing and storing specimens, which are of fundamental importance in the diagnosis of viral infection. The exams are performed using immunofluorescence techniques (at the Central Public Health Laboratories – LACENs), and through isolation and culture techniques in national reference laboratories¹⁰. In the case of Influenza A viruses, complete typing is essential, so that it is introduced in the annual composition of the vaccine in the southern hemisphere¹¹. In order to obtain a successful diagnosis, clinical samples must be collected within 3 days of the onset of symptoms for Influenza and RSV¹², and preferably between the 3rd and 4th day of illness, and may extend up to the 10th day for SARS-CoV-2¹³.

It is noteworthy that Influenza and RSV follow a seasonality, being etiological agents responsible for an important increase in the rates of hospital admissions per SARS in pediatrics. Thus, continuous analysis and monitoring of the behavior of respiratory diseases in the pediatric age group are fundamental surveillance tools to understand their epidemiology⁹. It is speculated that social isolation and hygiene measures (hand washing, mask, use of alcohol gel, suspension of school activities) have impacted on the reduction in the circulation of other viruses.

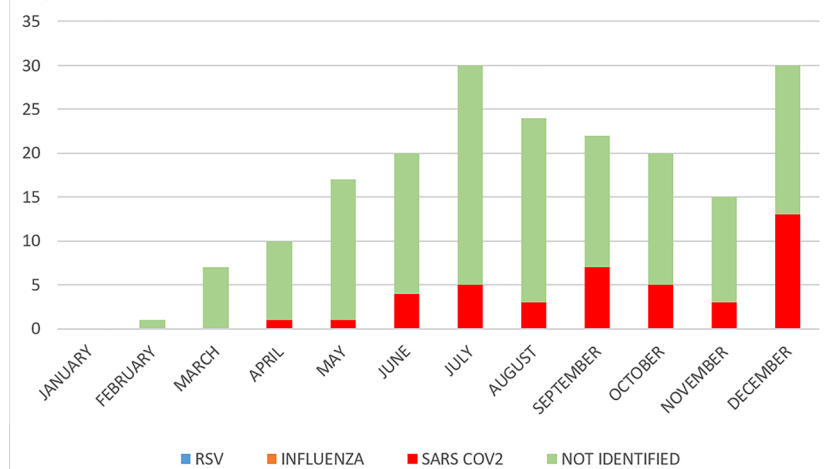
Another point to be taken into account is that with the restrictive measures of social isolation adopted to combat

Graph 1 - Distribution of RT-PCR performed in 2019 in a pediatric population - HRJP / FHEMIG



Source: Prepared by the authors with research data.

Graph 2 - Distribution of RT-PCR performed in 2020 in a pediatric population - HRJP / FHEMIG



Source: Prepared by the authors with research data.

the SARS-CoV-2 pandemic, it resulted in less circulation of the respiratory viruses that occurred with a seasonality pattern that was expected every year, according to data from previously released epidemiological bulletins (Graph 3).

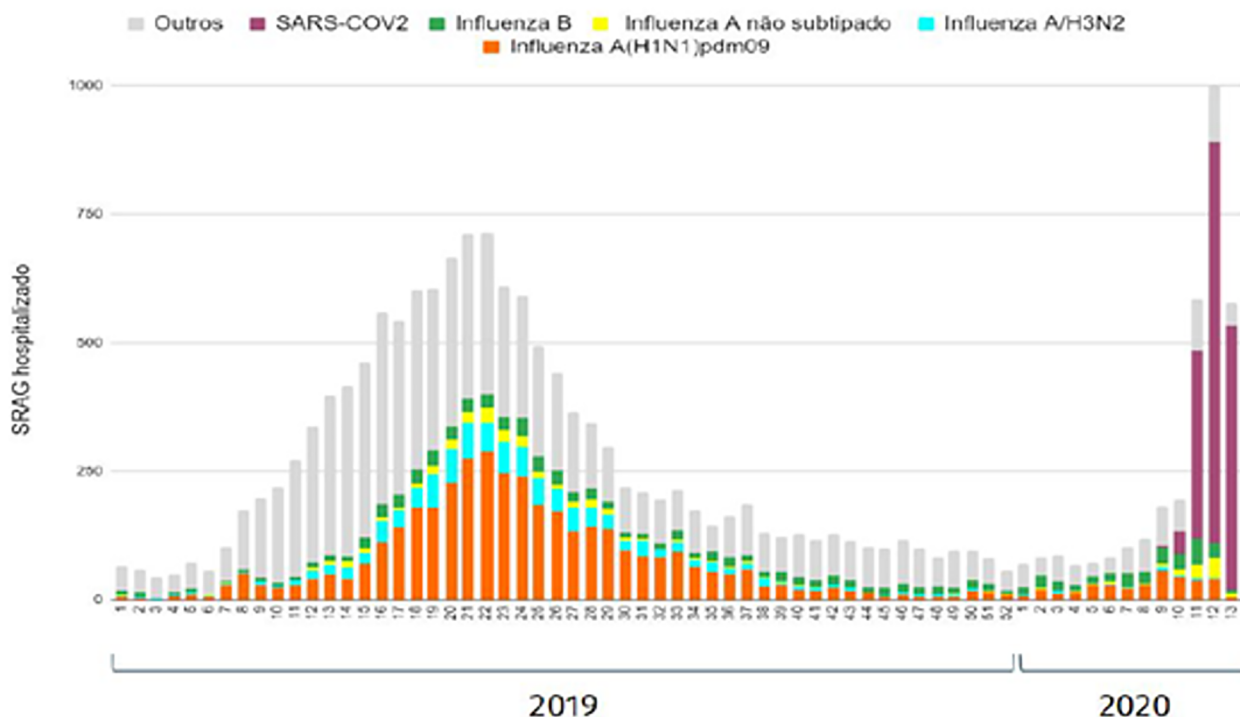
CONCLUSION

Viruses, as already known in the literature, play an important role in the etiology of respiratory conditions in Pediatrics, and should be taken into account in most respiratory diseases and valued in their potential severity.

Despite the change in the profile of the viruses presented in the pediatric population between 2019 and 2020, we cannot fail to request propaedeutics that would assist us in the search for the etiologic agent involved, thus making it important not only to request SARS-Cov-2 research, but also from other viruses like Influenza and RSV. We know that with the pandemic, children did not attend schools and day care centers for most of the year, so we inferred that there was less virus circulation.

Viral identification tests are tools of great applicability in the clinic, as they allow the identification of the etiologic

Graph 3 - Distribution of cases of Severe Acute Respiratory Syndrome by epidemiological week of onset of symptoms, according to a etiologial agent- Brazil, 2019 to 2020 until SE 13



agent and understand the disease process and the patient's evolution, in addition to guiding the best treatment option. The identification of possible viruses involved in respiratory conditions and their association with clinical, epidemiological, laboratory and radiological data, help the treatment not only based on the rational use of antibiotics, but also serving as a panorama to encourage the prevention of respiratory diseases.

Finally, we hope that with the advancement of vaccine coverage in priority populations (the elderly and those with comorbidities) and in groups with a higher risk of exposure to the virus (such as health professionals), we will have a substantial decrease in hospitalizations and deaths in all age groups. And, as soon as possible, we will be able to start safety and immunogenicity studies with the current vaccines available in the country for COVID-19 in children and adolescents with the aim of extending the benefit of vaccination to this group (protection of the severe form of disease), in addition to contributing to the control of virus transmission in the community.

COPYRIGHT

Copyright © 2021 Bamberg EL, et al. This is an Open Access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original article is properly cited.

CONTRIBUIÇÃO DOS AUTORES:

Bamberg EL: Substantial contributions to the conception and design of the study; acquisition, analysis, and interpretation of work data, drafting the text, discussion, and conclusion.

Nogueira RL, Pinheiro DAA, and Silva CM: substantial contributions to the conception and design of the study; elaboration of preliminary versions of the article and critical review of important intellectual content.

Castro SPA: orientation; substantial contributions to the conception and design of the study; analysis and interpretation of work data, drafting the text, discussion, and conclusion.

All authors approved the final version of the manuscript and are publicly responsible for the content of the article.

REFERENCES

- Berman S, Shanks MB, Feiten D, Horgan JG, Rumack C. Acute respiratory infections during the first three months of life: clinical, radiologic and physiologic predictors of etiology. *Pediatr Emerg Care* 2002;6(3):179-82.
- Ministério da Saúde Secretaria de Vigilância em Saúde Boletim Epidemiológico Especial – Doença pelo Coronavírus COVID-19. *Semana Epidemiológica* 48 (22/11 a 28/11/2020)
- Ministério da Saúde Secretaria de Vigilância em Saúde. Boletim Epidemiológico Especial – Doença pelo Coronavírus COVID-19. *Semana Epidemiológica* 49 (Nov 2019)
- Nair H, Nokes DJ, Gessner BD, Dherani M, Madhi SA, Singleton RJ, et al. Global burden of acute lower respiratory infections due to respiratory syncytial virus in young children: a systematic review and meta-analysis. *Lancet*. 2010;375:1545-55.
- Shann F. Etiology of severe pneumonia in children in developing countries. *Pediatr Infect Dis* 2012;5(2):247-52.
- Safadi MAP, Silva CAAD. The challenging and unpredictable spectrum of Covid-19 in children and adolescents. *Rev Paul Pediatr*. 2020 Sep 7;39:e2020192. doi: 10.1590/1984-0462/2020/38/2020192.
- Ministério da Saúde. Manual do usuário Gerenciador de Ambientes Laboratoriais - GAL- Secretaria Executiva do Departamento de Informática do SUS – DATASUS. Versão 2.6.0
- Sociedade Brasileira de Pediatria. Dados Epidemiológicos da Covid-19 em Pediatria. Nota Técnica. 17 de março 2021.
- Ministério da Saúde, Secretaria de Vigilância em Saúde. Boletim Epidemiológico Especial número 44. Doença pelo Coronavírus COVID-19. *Semana Epidemiológica* 53 (27/12/2020 a 2/1/2021).
- LACEN. Secretaria de Estado da Saúde, Superintendência de Vigilância em Saúde, Laboratório Central de Saúde Pública. Manual de orientação para coleta, acondicionamento e transporte de amostras biológicas. Estado de Santa Catarina. MCT 01. Ed/Ver 03/00.
- Ministério da Saúde, Fundação Nacional de Saúde (FUNASA). Guia de Vigilância Epidemiológica. Vol II – Influenza/Varíola. Brasília, agosto de 2002.
- Ministério da Saúde. Secretaria de Vigilância em Saúde Departamento de Vigilância das Doenças Transmissíveis. Guia para a rede laboratorial de vigilância de Influenza Brasil. Brasília – DF, 2016
- Secretaria de Estado de Saúde de Minas Gerais. Coronavírus. Acesso em 05 de abril de 2021. Disponível em: <<https://coronavirus.saude.mg.gov.br/blog/70-pcr-rt-para-coronavirus>>

