

# Analysis of respiratory virus prevalence in assisted children in a university hospital of southern of minas gerais

## *Análise da prevalência de vírus respiratórios em crianças atendidas em um hospital universitário do sul de Minas Gerais*

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### ABSTRACT

**Introduction:** Viral respiratory infections are of high incidence diseases in our midst. Viruses circulate throughout the year, however, the incidence of these infections increase with seasonality. Most of these infections occur in children because they are more likely immunologically. **Objective:** To analyze the prevalence of viral pathogens in respiratory infections in children aged 0 to 9 years old at the Samuel Libânio Clinical Hospital, Pouso Alegre-MG. **Methods:** A systematic review of data collected from aspirates oropharynx was performed to search for viruses by the Commission's Team of Nosocomial Infection Control between the years 2010 and 2014. **Results:** 310 samples were analyzed and about 26.4% of the samples were positive for a virus. Respiratory syncytial virus (RSV) was the most prevalent in children under one year old and also in the age group 1-4 years (25.3% and 11.1%, respectively), statistically significant ( $p < 0.001$ ). In the group between 5 and 9 years prevailed the virus Influenza A H1N1 with 13.8%. **Conclusions:** Viral infections contribute to a high number of hospitalizations that burden the public health system, especially in the pediatric age group. Thus, preventive measures such as vaccination campaigns should continue to be encouraged, preferably covering the most prevalent virus for a certain age group.

**Keywords:** H1N1 Viruses; Respiratory Tract Infections; Vaccines; Epidemiology; Respiratory Syncytial Virus Infections; Child.

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## RESUMO

**Introdução:** As infecções respiratórias virais são doenças de alta incidência no nosso meio. Os vírus circulam durante todo ano, todavia, a incidência destas infecções aumentam com a sazonalidade. Grande parte destas infecções ocorrem em crianças por serem mais susceptíveis do ponto de vista imunológico. **Objetivo:** Analisar a prevalência dos patógenos virais nas infecções respiratórias em crianças de 0 a 9 anos no Hospital das Clínicas Samuel Libanio (HCSL), Pouso Alegre - MG. **Métodos:** Foi realizada uma revisão sistemática dos dados coletados a partir de aspirados de orofaringe, para pesquisa de vírus pela equipe da Comissão de Controle de Infecções Hospitalares (CCIH), entre os anos de 2010 e 2014. **Resultados:** Foram analisados 310 amostras e cerca de 26,4% foram positivas para algum vírus. O vírus sincicial respiratório (VSR) foi o mais prevalente nas crianças menores de um e também na faixa etária de 1 a 4 anos (25,3% e 11,1 %, respectivamente), estatisticamente significativa ( $p < 0,001$ ). Já no grupo entre 5 a 9 anos prevaleceu o vírus Influenza A H1N1 com 13,8%. **Conclusão:** As infecções virais contribuem para um alto número de hospitalizações que oneram o serviço público de saúde, principalmente na faixa etária pediátrica. Deste modo, medidas preventiva como campanhas de vacinação devem continuar a ser incentivadas, de preferência abrangendo os vírus mais prevalentes para uma determinada faixa etária.

**Palavras-chave:** Vírus H1N1; Infecções Respiratórias; Vacinas; Epidemiologia; Infecções por Vírus Respiratório Sincicial; Criança.

## INTRODUCTION

Respiratory infections are the most common diseases in humans and single cause of absenteeism at school and work. Most of these infections occur in children and are caused by virus.<sup>1</sup> Viruses circulate throughout the year, however, the incidence of these infections increase with seasonality, especially in the months when temperatures fall: fall and winter. The clinic is marked by symptoms such as sudden onset of fever, even said, accompanied by cough or sore throat, headache, runny nose, myalgia or arthralgia.<sup>2</sup>

The approach to viral respiratory infections is relevant because of the high incidence and prevalence of this disease, including outbreaks. It is recalled that the winter of 2009 was marked by a viral pandemic, affecting several countries and leading to a global concern, particularly the lack of information on the subject. Because of the high power of the mutagenic virus feature, cough, a common symptom and often overlooked, it is relevant to the health surveillance services in the development of preventives proposals.<sup>3</sup>

The surveillance of such infections, as well as the determination of the most common agents is performed by collecting data of sentinel centers such as the Samuel Libânio Clinical Hospital (HCSL), in Pouso Alegre, Minas Gerais. Such information allows to assess and contribute to the development of vaccines that are effective for prophylaxis.

According to the literature review, there is a high frequency of use of antibiotics for flu-like illness without a direct relationship with bacterial coinfection. As most of the flu-like syndromes and upper and lower respiratory infections are caused by respiratory syncytial virus (RSV), antibiotic therapy should be considered more thoroughly. The diagnosis of a viral syndrome can prevent inappropriate use of these medicines, which can also cause bacterial superinfection in children with viral infections, and increase the side-effects and the costs of this treatment.<sup>4,5</sup>

Children are more susceptible to respiratory infections due to anatomical, physiological and immunological.<sup>6</sup> Among the most prevalent virus are: respiratory syncytial virus (RSV), human metapneumovirus (HMPV); adenovirus (ADV); parainfluenza (PIV) 1, 2, and 3; Influenza (Flu) A or B; rhinovirus; bocavirus; and coronavirus.<sup>5</sup> Several studies show that some factors such as breastfeeding, passive smoking, birth weight and income inequality influence the incidence of respiratory infections in children.<sup>7</sup>

To trace the etiological and epidemiological profile of the main agents responsible for respiratory infections is used a test with the polymerase chain reaction after reverse transcriptase (RT-PCR). This technique offers greater sensitivity and more timely diagnosis, obtaining quick results with equivalent sensitivity to direct antigen detection or viral isolation.<sup>8</sup>

Immunization of children historically achieved success in several countries, reaching different age groups and having an important role in the control and eradication of diseases. Besides having a good cost/effectiveness in the health sector is a major technological breakthrough in health in the last decades.<sup>9</sup>

The search for statistical information about diseases such as viral respiratory infections in children is a public health issue. Knowing the types of viruses isolated in the attendance units, its complications, the most common age ranges and seasonality allows tracing effective public policy actions to combat this high morbidity and mortality condition in the population examined in the study, as well as guard against future viral pandemics both feared.

This paper identified the major circulation respiratory viruses in the past four years more afflict children between the age group from 0 to 9 years old. The data is relevant because children under five years have high rates of influenza infection, as well as its complications, such as acute otitis media, bronchospasm attacks and pneumonias. This corresponds to a high demand for outpatient visits, emergency services and hospitalization.<sup>10</sup> The epidemic profile of respiratory infections in which the study outlined can be useful for planning and implementing some prevention strategies, serving as a statistical tool for making anti-influenza vaccines.<sup>8</sup>

The aim of the study was to analyze the prevalence of viral pathogens in respiratory infections in children aged 0 to 9 years in a hospital setting.

## METHODS

The survey was conducted at the HCSL, maintained by the Vale do Sapucaí University (UNIVÁS) in Pouso Alegre - MG, with the Commission's Team of Nosocomial Infection Control (CCIH) of the respective institution for assistance and surveillance for cases of influenza-like illness. This is a descriptive, observational, cross-sectional, non-controlled and added with informative purposes. The study population consisted of children from 0 to 9 years of age treated in the pediatric unit of HCSL to submit a flu-like illness. The study was approved by the Research Ethics Committee of UNIVÁS.

The children had at least three symptoms that include the flu syndrome. This is defined as a sudden onset of fever, even said, accompanied by cough or sore throat, headache, myalgia or arthralgia, in the absence of other specific diagnosis. 310 children were selected (n=310) with those symptoms, met in any industry HCSL, divided by age groups: younger than 1 year (n=175); 1 to 4 years (n=99) and 4-9 years (n=36).

Assigned to the unit sentinel HCSL / CCIH, to assist and surveillance of cases of flusyndrome, reported by employees of any unit SLCH. The material of nasopharyngeal secretions were collected by a single nurse, using 0.5 mL of phosphate buffered saline to liquefy the secretions, swabs and Rayon type and neonatal suction catheter for collection of nasal material, a total of 3 samples.

The samples were sent to the Ezequiel Dias Foundation in Belo Horizonte - MG, which made the viral isolation and

analysis of the presence of respiratory viruses by polymerase chain reaction technique (RT-PCR), and / or indirect immunofluorescence (IFI). Following was issued a reference against the results in the sample. Data were analyzed using the software Statistic XL and categorical variable studied was the type of virus isolated. The variable is described by qualitative proportions. The hypothesis test was applied Chi-Square and Binomial to a ratio. It was considered the level of rejection of the null hypothesis at 5% ( $p < 0.05$ ).

## RESULTS

The research involved a total of 310 samples in different age groups, the majority being male (167/310). The difference in the incidence of flu-like illness by gender was statistically significant ( $p = 0.0110$ ). (Table 1).

**Table 1** - Gender distribution in patients with acute viral infection

| AGE          | MALE | FEMALE | TOTAL |
|--------------|------|--------|-------|
| Less 1 year  | 103  | 79     | 182   |
| 1 to 4 years | 45   | 54     | 99    |
| 5 to 9 yers  | 19   | 17     | 36    |

In the present study about a quarter of the samples came positive (26.4%). In the group of children under one year positive samples for virus were 32.4% (59/182). The RSV was more prevalent with 25.3% (46/182). Then, the adenovirus infection corresponded to 3.8% prevalence (7/182). The influenza A H1N1 was 1.6% (3/182) of participation in infections for this group. Other viruses, influenza A H3N2, influenza B, parainfluenza 1, parainfluenza 2, parainfluenza 3, accumulated only 1.8% (3/182) of incidence. The negative results for virus isolation was 66.5% (121/182) and inconclusive corresponded to 1% (2/175). This difference was statistically significant ( $p < 0.0001$ ). In this group the majority of infants were male (103/182).

The group aged between 1 and 4 years RSV was also the most prevalent, with positivity of 11.1% (11/99). Then influenza H1N1 showed 2% (2/99). The parainfluenza 1, parainfluenza 2 and adenovirus obtained 1% each, with only one case for each viral agent. 3 samples parainfluenza and influenza A H3N2 were found. This difference in prevalence was statistically significant ( $p < 0.0001$ ). For this age group 45 were male while the female totaled 54. The positive sample for viruses in this group was 16.1% (16/99) while the negatives were 83.9% (83/99).

In the group between 5 and 9 years the most prevalent was the influenza A H1N1 with 13.9% (5/36). There was obtained no cases of respiratory syncytial virus. Influenza A H3N2, parainfluenza 1 and 2 obtained each 2.8% (1/36; 1/36; 1/36). Other viruses, such as influenza B, adenovirus and parainfluenza 3 were not isolated. The negative represented 69.34% (25/36). Inconclusive amounted to 8.33% (3/36). But this difference found in the prevalence of respiratory viruses was not statistically significant ( $p = 0.5004$ ) (Table 2).

**Table 2** - Distribution of each respiratory virus according to age group

| AGE          | POSITVITE SAMPLES (n=82) | RSV(n=57)  | InAH3N2(n=2) | InAH1N1 (n=10) | InfB(n=0) | Paraln (n=2) | 1 (n=3)   | 2        | Paraln3(n=0) | Adeno(n=8) |
|--------------|--------------------------|------------|--------------|----------------|-----------|--------------|-----------|----------|--------------|------------|
| <1 year      | 58 (70,7%)               | 46 (25,3%) | 1 (0,5%)     | 3 (1,1%)       | 0 (0,0%)  | 0 (0,0%)     | 1 (0,5%)  | 0 (0,0%) | 0 (0,0%)     | 7, (3,8%)  |
| 1 to 4 years | 16 (19,5%)               | 11 (11,1%) | 0 (0,0%)     | 2 (2,2%)       | 0 (0,0%)  | 1 (1,01%)    | 1 (1,01%) | 0 (0,0%) | 0 (0,0%)     | 1 (1,01%)  |
| 5 to 9 years | 8 (9,8%)                 | 0 (0,0%)   | 1 (2,7%)     | 5 (13,9%)      | 0 (0,0%)  | 1 (2,7%)     | 1 (2,7%)  | 0 (0,0%) | 0 (0,0%)     | 0 (0,0%)   |

## DISCUSSION

This study shows that respiratory viruses are common in respiratory infections of the upper tract, usually being found in children in hospital.<sup>4,5</sup> Our sample demonstrated that 26.5% (n=82) of oropharyngeal aspirates were positive for a respiratory virus. This value was lower than that found in a study conducted in Porto Alegre.<sup>1</sup> Watanabe *et al.*,<sup>11</sup> on the other hand, observed values higher than ours during the pandemic virus in São Paulo - SP, in the year 2009.

The respiratory pathogen most commonly found in children under one year was RSV, with a prevalence of 25.3%, followed by adenovirus (3.8%). Tsuchiya *et al.*<sup>12</sup> also noted the RSV as the most prevalent in Curitiba.

In the group of children aged 1 to 4 years, RSV was also the most prevalent, followed by the H1N1 influenza virus. These findings were similar to those found in Belo Horizonte, where the RSV and influenza virus H1N1 were the most frequent, respectively.<sup>13</sup> The RSV characterized by trigger a viral disease with high transmissibility, global spread and low lethality, with high rates of hospitalizations. It is a worldwide movement of virus responsible for causing annual outbreaks, affecting mainly young children.<sup>9</sup>

Among children aged 5 to 9 years, the H1N1 virus was the most prevalent and did not observe any cases related to RSV. This indicates that infection with this virus is related to the weakness of the immune system observed in the early childhood.<sup>1</sup>

São Paulo Hospital/Federal University of São Paulo, also a sentinel hospital in São Paulo (SP), more than 4,000 patients with symptoms similar to the flu were treated in 2009, during the first wave of influenza infection (H1N1), and 159 of them were hospitalized. Of the 159 hospital patients, the infection with influenza A (H1N1) was confirmed in 31 (19.5%).<sup>11</sup> Guatura *et al.*<sup>14</sup> also observed the influenza A (H1N1) as the most prevalent in their study. The symptoms simulating a flu syndrome mild to severe pneumonia and death, and the first wave of the outbreak of A (H1N1) led to a large number of hospitalizations for suspected infection also that year.<sup>15</sup>

It was not found rhinovirus infection at any age, unlike other studies where it was the most prevalent.<sup>6,16</sup>

Hospitalizations due to viral infections remain a major cause of hospital admission in children worldwide. Infections of the lower airways in this age group account for more than 100,000 hospitalizations in the United States each year. In our study, as well as in the studied literature, the prevalence of respiratory syncytial virus was vastly superior to the other viruses, mostly in children under five years, with a predominance on male sex.<sup>12,13</sup>

Even with the knowledge of the high incidence of viral RSV infection, there is a wide variety of clinical forms, such as viral pneumonia, pleural effusion, infection of the upper airways, bronchiolitis, recurrent wheezing and others. Although with this information the clinical and radiological

criteria were not sufficient to identify the respiratory syncytial virus. Thus the children received antibiotics with a certain frequency, which increases the hospital costs unnecessarily.<sup>4</sup>

According to the literature, our data are consistent and generate some discussion about the theme. The palivizumab is a humanized monoclonal antibody which has a neutralizing and inhibitory activity against RSV. It is a drug that induces passive immunization. Currently, such medication is indicated by the Ministry of Health, from the year 2012, only for premature infants born at 32 weeks or less and children up to two years with chronic lung disease or congenital heart disease with hemodynamic repercussions demonstrated. It was observed that, among hospitalized children, pretreatment with palivizumab significantly reduced the number of hospital days and the number of days with increased need for oxygen.<sup>17</sup> As this virus the main agent responsible for expenses, the use of this monoclonal antibody could reduce these numbers.

Among preventive measures, it was developed the vaccine against influenza A H1N1, containing the inactivated virus and is administered intramuscularly in two doses for children 6 months to 2 years. The vaccination campaign began on March 8, 2010 and was available exclusively for children in this age group. Already in 2014 the age was increased from 6 months to 5 years. We believe that this measure has been effective and great value, since in our study the incidence was very low in children under 5 years.<sup>18</sup>

Should also be encouraged the use of relatively simple measures for the population, such as frequent hand washing with soap, water and alcohol.<sup>19</sup>

Our study had some limitations. In all age groups found a high number of negative values for viruses, ie those for viral isolation technique PCR did not reveal the presence of any strain. This can be explained by the fact that older children already present secondary bacterial infections that to some extent simulate the flu syndrome.

In conclusion, it was observed that viral infections are very common in children with high prevalence of RSV in children under 5 years. A measure that could reduce its incidence, specially in this age group would be the use of palivizumab, expanding its intended use. However, such action should be studied, since such medication demand high cost and an awareness of the professionals on the subject. It was believed that the low incidence of the virus Influenza A H1N1 in patients up to 5 years in our study was the use of vaccination recommended by the Ministry of Health from 6 months old.

Thus, we believe that vaccination campaigns should continue to be encouraged and preferably covering the most prevalent virus for a certain age group.

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