

Clinico-etiological and epidemiological particularities of respiratory virus diseases in children in the 2022-2023 season

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ABSTRACT

In the period 2020-2022 as a result of epidemiological measures specific to the COVID-19 pandemic (protective mask, online teaching activity, social distancing) we witnessed a considerable decrease in the number of cases of respiratory viroids in children. With the lifting of prophylactic measures that coincided with the start of physical teaching activities and the onset of the cold season, we have been confronted in pediatric wards with an increase in the incidence of virological infections in the pediatric population.

In this article we aim to analyze the particularities of respiratory virological diseases in children in the season 2022 - 2023 both from the etiological and epidemiological point of view and the characteristic clinical forms of the disease. We conducted a retrospective clinical study of cases admitted to the Clinical Departments of Infectious Diseases-Pediatrics of the National Institute of Infectious Diseases “Prof. Dr. Matei Bals” in the period October 2022 - March 2023.

During this period, we recorded 3.012 cases of respiratory virology in children, which represents the majority of pediatric pathology admitted (72,9 %). The peak incidence of respiratory virology occurred in December (688 cases). From the etiological point of view, most cases were SARS-CoV-2 infections, followed by influenza (predominantly type A), then a smaller number of infections with respiratory syncytial virus (RSV), rhinovirus, adenovirus, metapneumovirus.

The most common clinical form of the disease was moderate (66.9%), with severe forms accounting for 10.5%. All pediatric cases of respiratory virology admitted to our wards have evolved favorably, with no deaths.

Keywords: respiratory virus, child, season 2022-2023

INTRODUCTION

With the discontinuation of specific prophylactic measures against COVID-19, we are witnessing in autumn 2022 the emergence of waves of viral infections (*influenza, SARS-CoV-2 infection, adenovirus infection, rhinovirus, RSV, parainfluenza viruses, metapneumovirus and all*) [1].

Respiratory viruses are an important cause of morbidity in the pediatric population due to their increased incidence, especially in the cold season,

both because of the high degree of infectiousness and because of the severe clinical forms of the disease which can lead to complications and even death. Severe forms of the disease are more common in children with co-morbidities (heart disease, lung disease, diabetes, systemic diseases, congenital or acquired immunodeficiencies, malignancies) [2].

Particularly for these viroids, they are more severe clinical forms of the disease with multiple complications as well as their association with each other but also bacterial and parasitic coinfections. It was

also found that clinical forms of diseases and coinfections predominantly affect younger age groups, a risk factor for severity and frequent complications [3].

The introduction of prophylactic measures for COVID-19 has led to a significant decrease in the number of influenza cases over the last two years, resulting in a lack of natural immunity in the majority of the population [4,5]. Children, especially young children (0-4 years) are the most vulnerable to illness as they have not had contact with influenza viruses and maternal immunity is not present in this situation. In this age group there is practically no natural immunity, so they are prone to more severe forms of respiratory viruses.

OBJECTIVES

In this paper we aim to analyze the epidemiological and etiological peculiarities of respiratory virus infections in children in the post-pandemic COVID-19 season. We will also identify the clinical forms of disease, complications and evolution of childhood viroids in the 2022-2023 season (October 2022 - March 2023).

MATERIAL AND METHOD

In order to achieve the proposed objectives, we conducted a retrospective clinical study of pediatric cases of respiratory virology admitted to the Pediatric Infectious Diseases Clinical Departments of the National Institute of Infectious Diseases “Prof. Dr. Matei Bals” in the period October 2022 - March 2023. In these cases, we analyzed the distribution of cases during the period, the etiology of respiratory virus diseases in children, the clinical forms of the disease, and the associated coinfections and their impact on the clinical forms of the disease. The diagnosis of respiratory viroids was based on epidemiological, clinical and laboratory criteria (PCR - Biofire test that identifies several types of viruses from nasal secretions: *SARS-CoV-2*, *human community coro-*

naviruses, *influenza A and B viruses*, *parainfluenza*, *adenoviruses*, *RSV*, *rhinovirus*, *bocavirus* and *meta-pneumovirus*.

RESULTS AND DISCUSSION

Between October 2022 and March 2023 in the pediatric wards of the National Institute of Infectious Diseases, 3,012 cases of respiratory virology in children were admitted, representing 72.9% of all pediatric admissions during the period. There were no deaths; all cases evolved favorably.

The number of respiratory virological cases peaked in December 2022, but there are epidemiological peculiarities of each individual virus. *Influenza viruses*, *parainfluenza viruses*, *rhinoviruses*, *adenoviruses* and *bocaviruses* follow the usual seasonality, whereas coronaviruses (*SARS-CoV-2* and *human coronaviruses*) and *metapneumoviruses* show an upward trend in incidence during the period analyzed (Table 1).

Figure 1 shows that the 2022-2023 season of respiratory virus infections in children evolved biphasically, with a peak in incidence in December but also with an increasing trend in March due mainly to a high number of cases of COVID-19. This proves that SARS-CoV-2 infection is not seasonal and occurs in epidemic “waves”. The results obtained in our study are similar to data reported by other authors in similar research [6].

During the period analyzed, COVID-19 was the main respiratory viroid we faced, with the number of cases representing 41.2% of all childhood viroids. Infection with the SARS-CoV-2 virus in children peaks in terms of incidence in March 2023, with the particularity of being associated with other viral and bacterial infections, thus favoring the appearance of more severe clinical forms of the disease with a prolonged evolution (Figure 2). In terms of the clinical forms of COVID-19 disease in children, these are predominantly mild and moderate, while severe forms are present in children with comorbidities.

TABLE 1. Number of cases of respiratory viroids in children

Type virus/month	October	November	December	January	February	Marth	Total
SARS-CoV2	140	125	206	214	202	354	1.241
Influenza A	2	6	183	223	130	73	617
Influenza B	2	4	8	8	19	35	76
Respiratory syncytial virus	7	69	98	14	5	2	195
Rhinovirus	15	24	36	11	15	19	120
Adenovirus	10	21	32	27	31	20	141
Coronavirus	0	4	7	2	8	11	33
Bocavirus	0	2	4	5	0	2	13
Meta-pneumovirus	1	2	8	6	14	9	40
Parainfluenza	5	10	6	1	0	0	21
Unspecified	93	110	97	60	58	97	515
Total	275	377	685	571	482	622	3.012

Human community coronaviruses also show a similar epidemiological evolution to SARS-CoV-2, with a peak in March, as they are known to have an increased incidence in the warm season (Figure 3).

However, during the period analyzed, we recorded a small number of infections with *human community coronaviruses* (33 cases), which represents 1.1% of the total number of childhood viroids. The results regarding the epidemiology of coronavirus infection in children obtained in our study are consistent with those reported by other authors [7, 8].

Regarding influenza, it can be observed that this disease maintains its seasonality with an upward trend in the number of cases, so that the peak of incidence was reached in December (Figure 4). In terms of the number of cases, influenza A is the second most common viral illness, accounting for 20.4% of pediatric cases admitted.

In the 2022-2023 season, *influenza type B* in children is evolving in a particular way, in the sense that the number of cases has steadily increased, reaching a peak in incidence in March (Figure 5).

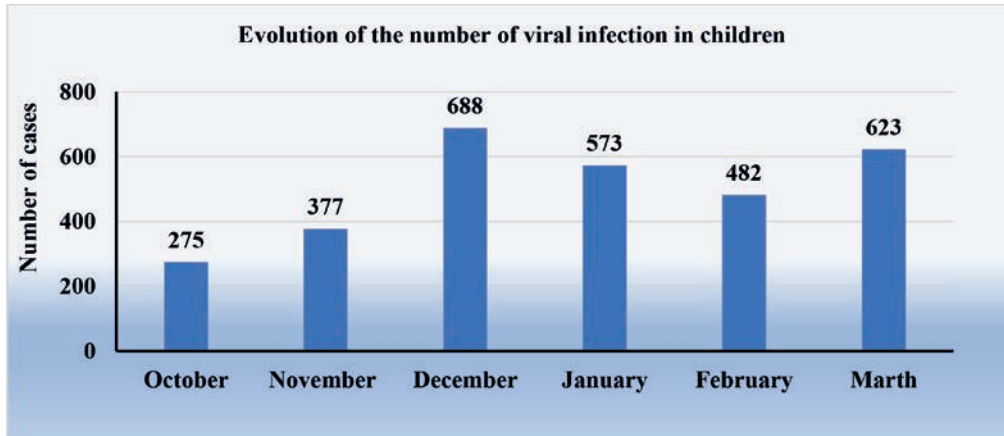


FIGURE 1. Evolution of the number of cases of viral infections in children

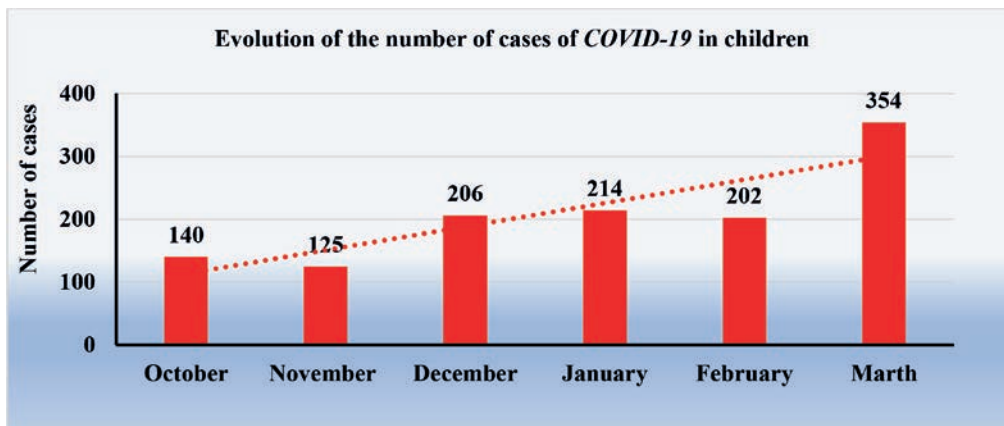


FIGURE 2. Evolution of the number of COVID-19 cases in children

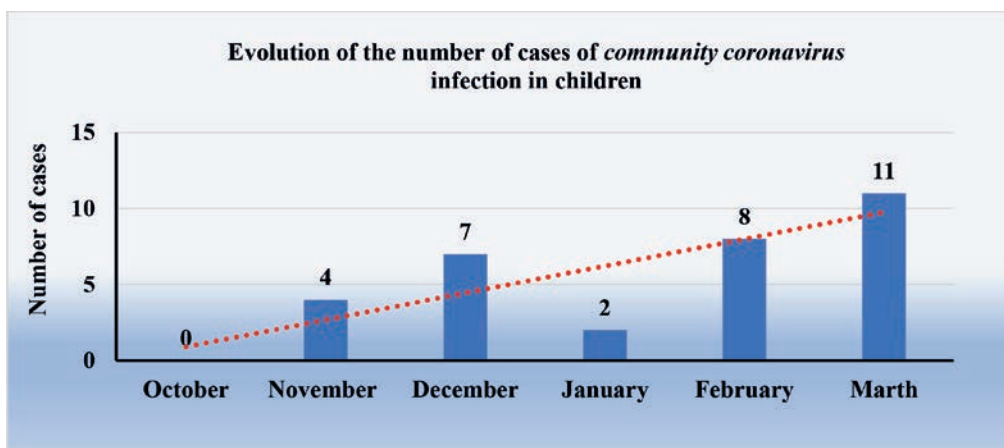


FIGURE 3. Evolution of the number of cases of community coronavirus infection in children

However, the number of cases is small (76/693) compared to those of influenza type A, not influencing the epidemiological evolution of influenza in general.

The percentage of cases of *influenza B* in children is 2.5% of all cases and 10.9% of all pediatric influenza cases.

The clinical forms of influenza recorded in the 2022-2023 season were more severe than in previous years, especially in cases associated with other viral coinfections or bacterial superinfections. In

the specialized literature, regarding the clinical-epidemiological aspects of influenza in children in the 2022-2023 season, data similar to those in our study are reported [9, 10].

RSV infection in children has shown a similar epidemiological evolution as in previous years, reaching a peak in incidence in December 2022 (Figure 6). The total number of cases was low compared to SARS-CoV-2 or *influenza* infection, accounting for only 6.4% of all pediatric RSV infections in the 2022-2023 season. What we noted clinically was the in-

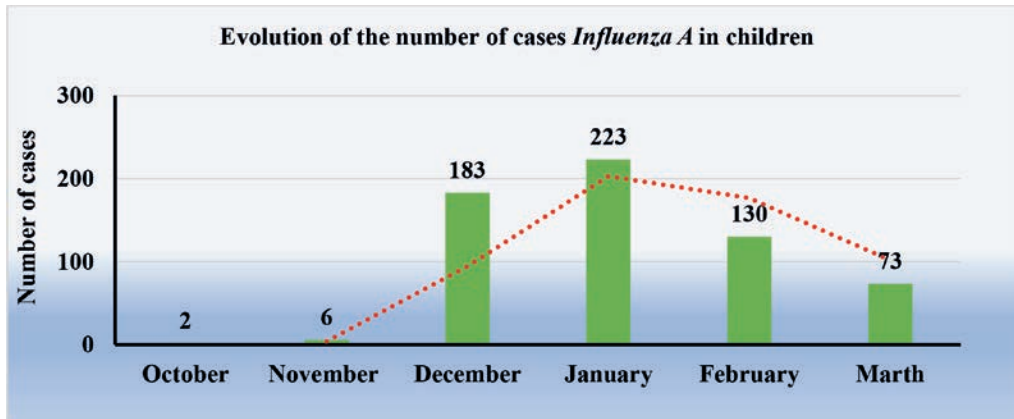


FIGURE 4. Evolution of the number of cases of *Influenza type A* in children

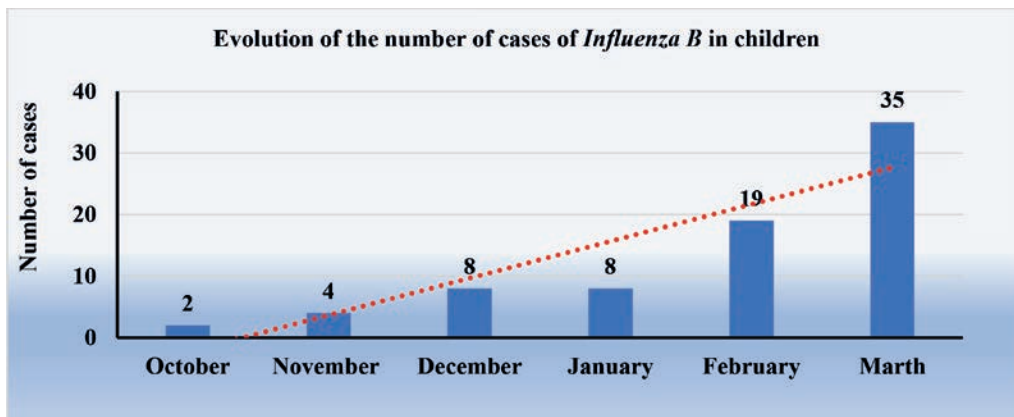


FIGURE 5. Evolution of the number of cases of *Influenza type B* in children

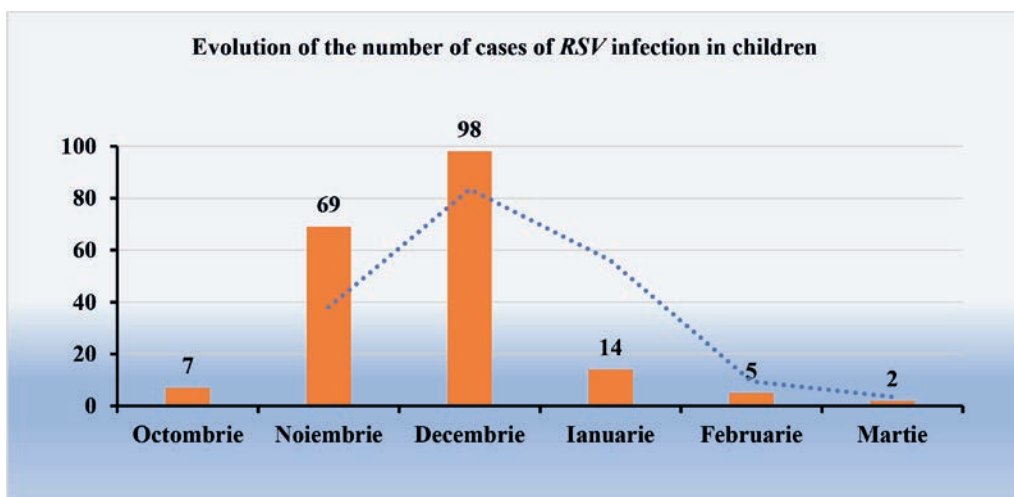


FIGURE 6. Evolution of the number of cases of RSV infection in children

creased number of severe forms of illness (31.8%), frequently complicated by acute respiratory failure and bacterial superinfection. The association with other viral infections is a factor favoring the development of more prolonged and severe clinical forms of the disease. The same data on the epidemiological and clinical aspects of RSV infection in children are reported by other authors in similar clinical studies [10,11].

Infection with *parainfluenza viruses* generally follows the seasonality of respiratory illness in children. We recorded a small number of pediatric cases of infection with parainfluenza viruses, representing 0.7% of all viruses in the 2022-2023 season. Clinical forms of illness were predominantly mild or moderate, while cases of viral or bacterial coinfection progressed more severely. Figure 7 shows that the peak incidence of cases was reached in November.

The results obtained by us in our study on the epidemiology of infection with *parainfluenza viruses* in children are comparable to those reported in the specialized literature during the same period [12].

Acute rhinovirus infection in children represents 3.9% of all respiratory viruses in the 2022-2023 season. From Figure 8 it can be seen that these follow the seasonality of pediatric respiratory viroids, with a peak in incidence in December 2022. From the

analysis of the clinical forms of the disease we see a higher percentage of severe forms 26.6% (32/120) compared to previous seasons, the most common complication being acute respiratory failure.

Similar data regarding *rhinovirus* infection in the 2022-2023 season is also reported by a group of researchers in their work published in the *Journal de Pediatria* [13].

Adenovirus infections in children account for 4.7% of all pediatric virological infections admitted to the pediatric wards of the National Institute of Infectious Diseases “Prof. Dr. Matei Bals” between October 2022 and March 2023. The clinical forms of the disease were predominantly mild but we also recorded severe forms especially in the case of viral or bacterial coinfections. The incidence of pediatric cases of acute adenovirus infection remains approximately constant throughout the period analyzed, which proves that this disease does not have seasonality, but it can be observed that there are more cases in the cold season (Figure 9). A group of authors from China report clinical and epidemiological data on *adenovirus* infections in children similar to those obtained by us in our study [14].

In the study we also identified some cases of acute bocavirus infection in children, with a peak incidence in January 2023, but the study is not statis-

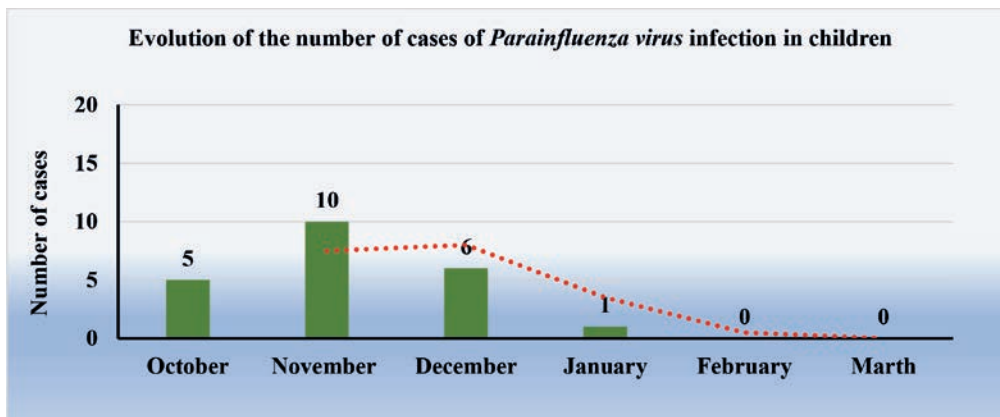


FIGURE 7. Evolution of the number of cases of *parainfluenzaviruses* infection in children

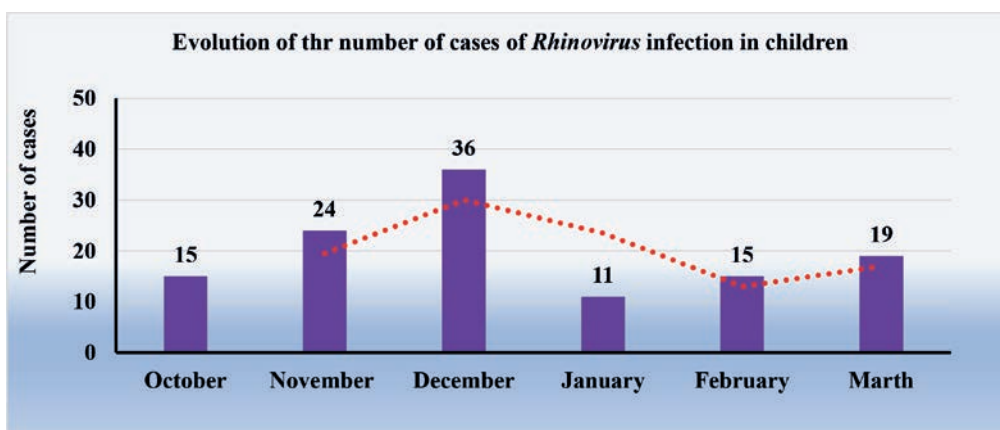


FIGURE 8. Evolution of the number of cases of *rhinovirus* infection in children

tically significant due to the small number of cases (Figure 10). Childhood *bocavirus* infection accounts for 0.4% of all respiratory viroids.

The clinical forms of the disease were average, we did not register severe forms of acute *bocavirus* infection in children. Similar data on the clinical and epidemiological aspects of *bocavirus* infection in children are reported in other clinical studies [15].

During the period analyzed, acute *metapneumovirus* infection in children peaks in January 2023 (Figure 11). In terms of seasonality, we can say that most cases were recorded in February 2023, and in terms of clinical forms of the disease predominated the medium ones. We also observed some severe

clinical forms of acute *metapneumovirus* infection in children, complicated with acute respiratory failure and/or viral or bacterial coinfections. The same conclusions are emphasized by other authors in specialized clinical studies on the epidemiology and clinical manifestations of *metapneumovirus* infection in children [16].

However, due to the small number of cases the results are not statistically significant, with acute *metapneumovirus* infection accounting for only 1.3% of all pediatric respiratory illnesses admitted during the period analyzed.

During the period analyzed we also recorded 6 cases of measles in unvaccinated children, who presented with moderate forms of the disease with a

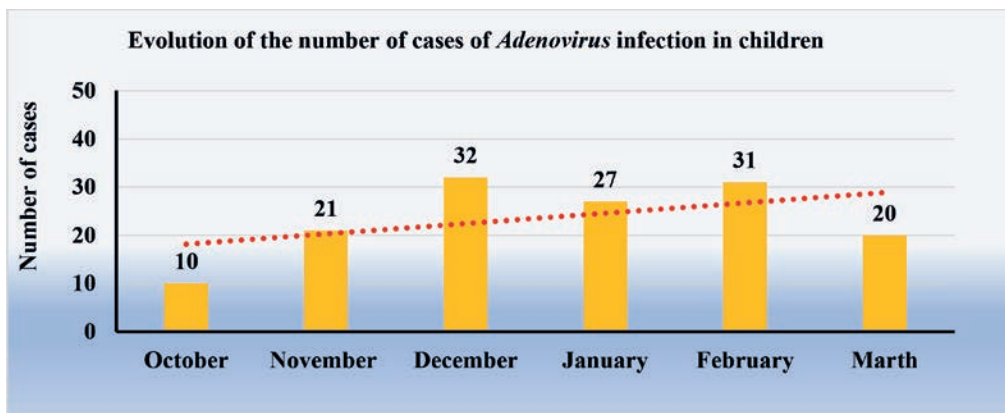


FIGURE 9. Evolution of the number of cases of *adenovirus* infection in children

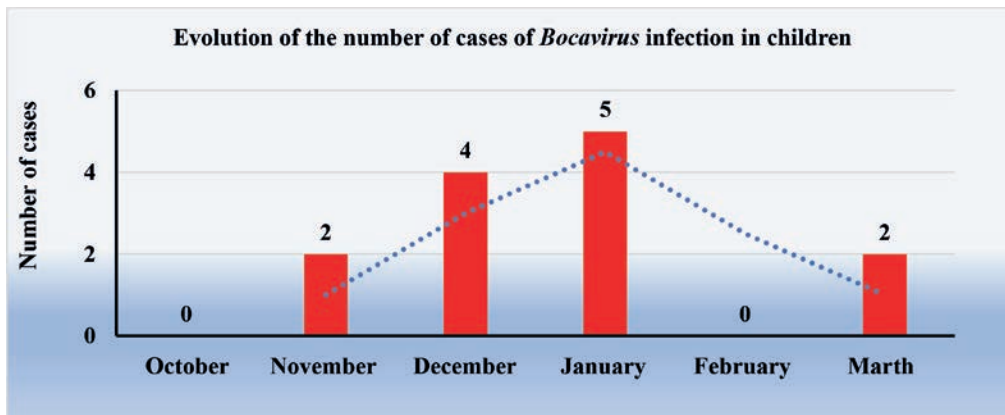


FIGURE 10. Evolution of the number of cases of *bocavirus* infection in children

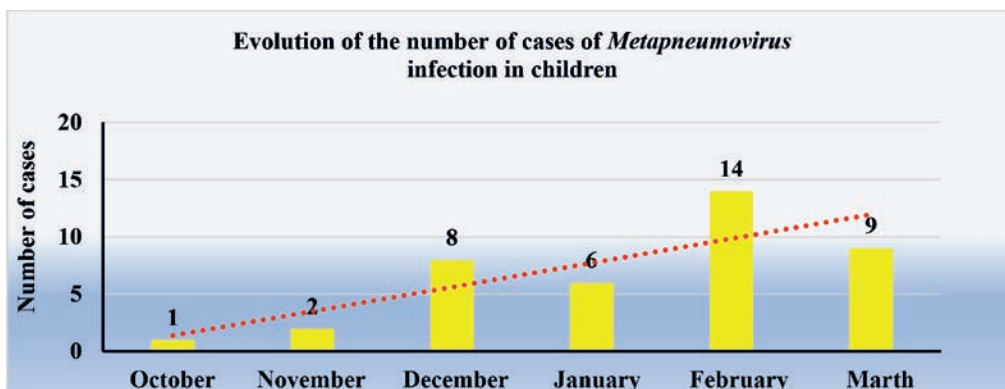


FIGURE 11. Evolution of the number of cases of *metapneumovirus* infection in children

favorable evolution and without severe complications [17].

In 17% of the cases, it was not possible to establish the etiological diagnosis of respiratory virus infection, which was based on clinical, epidemiological and laboratory data (characteristic haemolucogram, negative inflammatory samples).

From the analysis of the clinical forms of the cases of respiratory virus admitted in children, it can be seen that the majority are medium (66.9%), while severe forms represent only 10.5% of the cases (Table 2).

TABLE 2. Distribution of clinical forms of respiratory viroids in children

Disease form	Number of cases	Percentage (%)
Mild	681	22.5
Medium	2.019	66.9
Severe	318	10.5
Total	3.018	100

The most severe clinical forms were recorded in children with respiratory viroids complicated with respiratory failure, but also in cases associating viral and bacterial coinfections. The most severe cases we found in pediatric cases of *influenza*, *respiratory syncytial virus infection* and *rhinovirus*.

From the analysis of the cases of respiratory virology in children in the season 2022-2023 we see that after the COVID-19 pandemic, the number of cases increased due to the abandonment of protective measures and due to the lack of acquired immunity of the population during this period. The clinical forms of illness of childhood respiratory virus disease have been more prolonged and severe due to an increase in the number of viral or bacterial coinfections. Similar conclusions are emphasized by other authors in the specialized literature regarding the clinical forms of the disease of respiratory viruses in children in the post-COVID-19 era [18].

CONCLUSIONS

During the period under review, we note the re-emergence of seasonal viral respiratory diseases with certain particularities caused by the post-pandemic COVID-19 conditions (abandonment of specific protective measures, no natural immunity formed, immunosuppressed host terrain, considerable reduction in the number of cases of viral respiratory infections in the last two seasons).

One of the most important features of the 2022-2023 season from an epidemiological point of view is that coronavirus infections are not seasonally specific compared to influenza viruses, adenoviruses, respiratory viruses, rhinoviruses, bocaviruses, metapneumoviruses which have retained their known seasonality. We also see a very high number of infections with SARS-CoV-2 and influenza viruses compared to other respiratory viruses (63.1%).

Another peculiarity of the 2022-2023 respiratory virus season is the higher number of severe cases (10.5%) due to COVID-19 induced immunosuppression in a population not naturally immunized with respiratory viruses in the last two years.

The increased number of coinfections associated with respiratory viruses is another feature of the 2022-2023 season. The most common were bacterial superinfections (11.2%) often leading to severe forms of disease (sepsis) and viral coinfections (6.9%) leading to respiratory complications, with acute respiratory failure being the most severe. Thus, bacterial and viral coinfections resulted in more prolonged and severe clinical forms of disease with risk of adverse outcome and aftereffects.

In these circumstances, the application of non-specific prophylactic methods (avoiding crowding, frequent ventilation of rooms, wearing a mask, secretion hygiene, isolation of symptomatic patients) together with specific methods (vaccination) in the case of influenza and SARS-CoV-2 infection are effective methods of preventing respiratory illness.

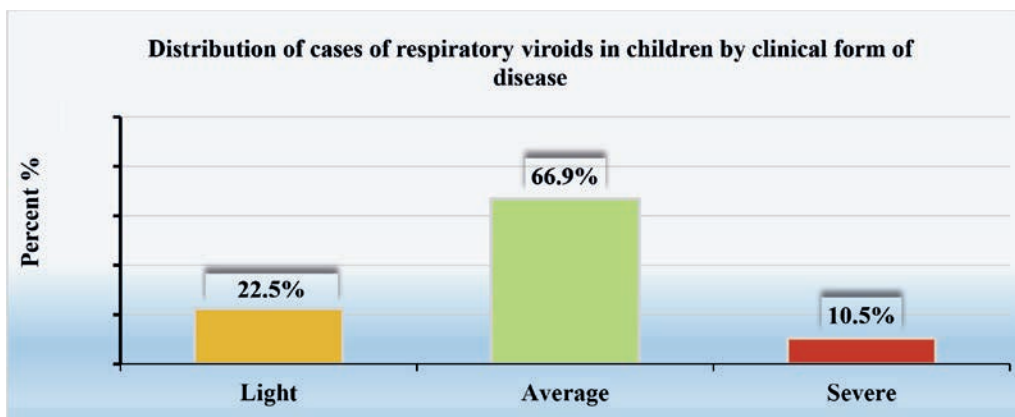


FIGURE 12. Distribution of cases of respiratory viroids in children by clinical form of disease

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