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Temporal Pattern of Viral Respiratory Infections and Influenza and COVID-19 Vaccination Coverage in Individuals Under 19 Years of Age in the Federal District, 2024–2025

Temporal Pattern Of Viral Respiratory Infections And Vaccination Coverage Against Influenza And COVID-19 In Individuals Under 19 Years Of Age In The Federal District, 2024–2025

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Summary

This study evaluates the temporal distribution and vaccination coverage of influenza and COVID-19 in children under 19 years of age in the Federal District in 2024 and 2025. Secondary data were obtained from the Notifiable Diseases

Information System (SINAN), the National Immunization Program Information System (SI-PNI), and official epidemiological reports. Notified cases of viral respiratory infections, stratified by age group, epidemiological week, and etiological agent, were analyzed, as well as influenza and COVID-19 vaccination coverage by age group. The results indicate distinct seasonal patterns for influenza and COVID-19, with a higher incidence among children aged 0 to 4 years. Vaccination coverage declined compared to previous years, especially for the 5 to 14 year age group, suggesting the need for reinforced vaccination campaigns and targeted communication strategies. The study contributes to the understanding of the dynamics of viral respiratory diseases in the post-pandemic context and reinforces the importance of public policies for prevention.

Keywords: Influenza, COVID-19, vaccination coverage, children, adolescents, Federal District, epidemiological surveillance.

Abstract

This study evaluates the temporal distribution of viral respiratory infections and vaccination coverage against influenza and COVID-19 among individuals under 19 years of age in the Federal District, Brazil, during 2024 and 2025. Secondary data were obtained from the Notifiable Diseases Information System (SINAN), the National Immunization Program Information System (SI-PNI), and official epidemiological reports. Reported cases of viral respiratory infections were analyzed and stratified by age group, epidemiological week, and etiological agent, as well as influenza and COVID-19 vaccination coverage by age group. The results indicate distinct seasonal patterns for influenza and COVID-19, with higher incidence among children aged 0 to 4 years. Vaccination coverage showed a decline compared to previous years, particularly among individuals aged 5 to 14 years, suggesting the need to strengthen vaccination campaigns and targeted communication strategies. This study contributes to the understanding of the dynamics of viral respiratory diseases in the post-pandemic context and reinforces the importance of public health policies for prevention.

Keywords: Influenza; COVID-19; vaccination coverage; children; teenagers; Federal District; epidemiological surveillance.

1. Introduction

Viral respiratory infections (VRIs) constitute a significant public health problem.

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being responsible for high morbidity and mortality in children and adolescents. It also represents a

one of the main causes of pediatric care and hospitalization, especially in infants and children.

in preschool age. Agents such as respiratory syncytial virus (RSV), rhinovirus, influenza and

SARS-CoV-2 exhibits distinct seasonal patterns and varying impact depending on age. Among the

The most relevant agents are influenza and SARS-CoV-2, which continue to circulate in a way...

endemic and seasonal in several regions of the world. In Brazil, the post-COVID-pandemic period

19 brought significant challenges to epidemiological surveillance, mainly in relation to coverage.

vaccination and case detection in pediatric populations.

Vaccination is the main preventive strategy against these infections, reducing the risk.

risk of hospitalizations and deaths. However, recent studies indicate a reduction in coverage.

Vaccination in several regions, associated with factors such as vaccine hesitancy, logistical difficulties and

The impact of the pandemic on health services.

The Federal District has unique characteristics, with a high population density,

Great mobility and socioeconomic diversity are factors that can influence the spread.

Viral infection (IRV) and adherence to vaccination campaigns. Evaluate the temporal pattern of IRVs and coverage.

Vaccination in children under 19 years of age is essential to identify gaps in immune protection and provide guidance.

public policies and optimize vaccination strategies.

This study aims to analyze the temporal distribution of IRVs and vaccination coverage.

of influenza and COVID-19 in children under 19 years of age in the Federal District in the years 2024 and 2025, with

Focus on variations by age group, epidemiological week, and etiological agent.

2. Materials and Methods

This is an observational, descriptive, and retrospective study based on data.

secondary indicators of epidemiological surveillance and vaccination coverage.

This included children and adolescents under 19 years of age residing in the Federal District, who

had notification of viral respiratory infection between January 1, 2024 and December 31, 2025.

2025.

The data sources used were SINAN: notifications of IRV cases, including influenza and COVID-19, stratified by age, sex, epidemiological week, etiological agent and outcome. SI-PNI: data on doses of influenza and COVID-19 vaccine administered, by age group and Official epidemiological reports from the Ministry of Health and the Health Department of the Federal District.

Variables analyzed include Age: 0–4, 5–9, 10–14 and 15–18 years, Etiological agent: Influenza, SARS-CoV-2, other respiratory viruses, Vaccination coverage: percentage of children and Adolescents vaccinated by age group. The period includes epidemiological weeks 2024 and 2025.

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For the clinical outcome, hospitalization, death, or discharge were considered.

Weekly incidence rates per 100,000 inhabitants were calculated. Vaccination coverage was expressed as a percentage by age group and year. The temporal pattern was analyzed using graphs of weekly series to identify seasonal peaks. The analysis was performed using Excel and software. Statistical tool R. Limitations include underreporting and inconsistencies in records, data that were considered in the work.

3. Results and Discussion

4,900 cases reported in 2024 were analyzed. The distribution by sex revealed a slight predominance of males, with 2,696 cases (55.0%), while females represented 2,204 cases (45.0%). This pattern is consistent with findings described in the literature, which suggest greater male vulnerability to respiratory infections in childhood, possibly related to immunological and hormonal factors.

Analysis by age group revealed a marked concentration of cases in younger children. of two years, which corresponded to 3,108 notifications (63.4%). The age group from 2 to 10 years It concentrated 1,618 cases (33.0%), while adolescents aged 11 to 19 represented only 174. cases (3.6%). These data reinforce the understanding that infants and young children constitute the main risk group for viral respiratory infections, both in terms of incidence and of clinical severity.

Regarding etiology, respiratory syncytial virus (RSV) and rhinovirus stood out. as predominant across all age groups, which together accounted for the majority of detections laboratory tests. RSV is especially relevant in children under two years of age, being the main agent. associated with both the occurrence of cases and fatal outcomes. Rhinovirus also presented Widespread across all age groups, with higher frequency among older children and school-aged children.

Adenovirus was the third most frequently identified agent, with distribution relatively homogeneous throughout the year. Other respiratory viruses, such as metapneumovirus, Parainfluenza and bocavirus were observed at low frequencies. Viral co-detection was not observed in the Data analyzed. COVID-19 and influenza represented a smaller proportion of the total cases, however. with continuous circulation throughout the year, especially in specific weeks, demonstrating that These agents remain relevant in the post-pandemic scenario.

Mortality associated with viral respiratory infections was relatively low when Compared to the total number of cases, however, it showed a strong concentration in the older age groups. young people. A total of 27 deaths were recorded, of which 19 (70.4%) occurred in children under two years old. years, 7 (25.9%) in children aged 2 to 10 years and only 1 (3.7%) in adolescents. Most deaths

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RSV was highlighted again, followed by rhinovirus. Cases classified as "non-

The factors specified also contributed significantly to mortality, indicating possible

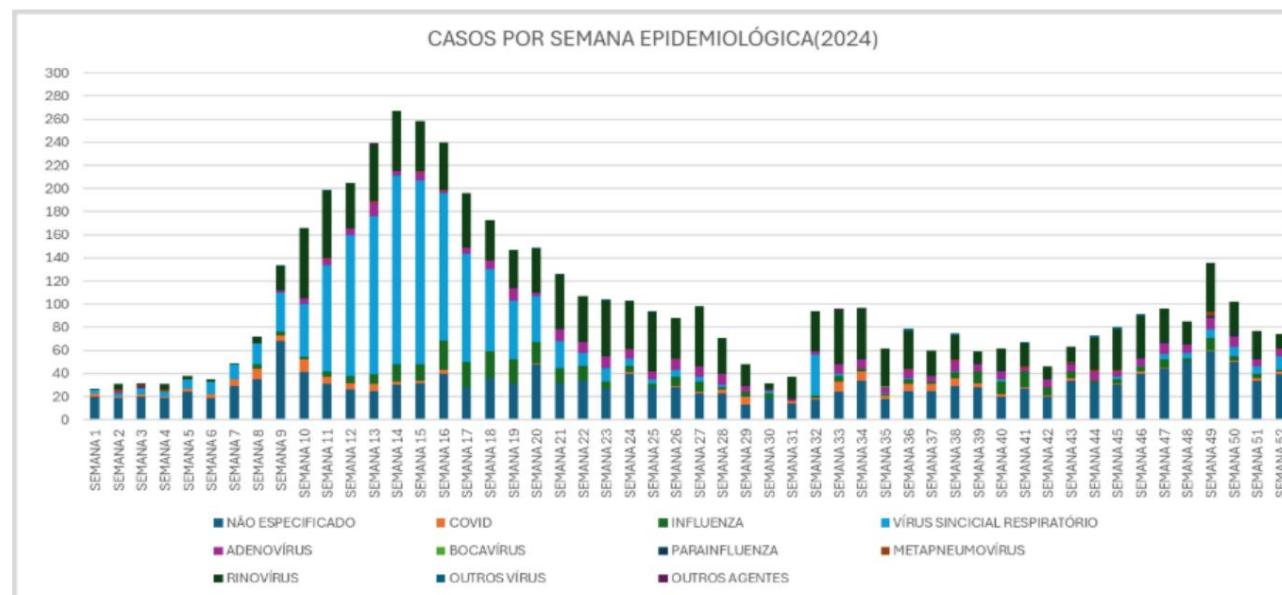
Limitations in the etiological identification of the agents involved. Deaths attributed to COVID-19 and to

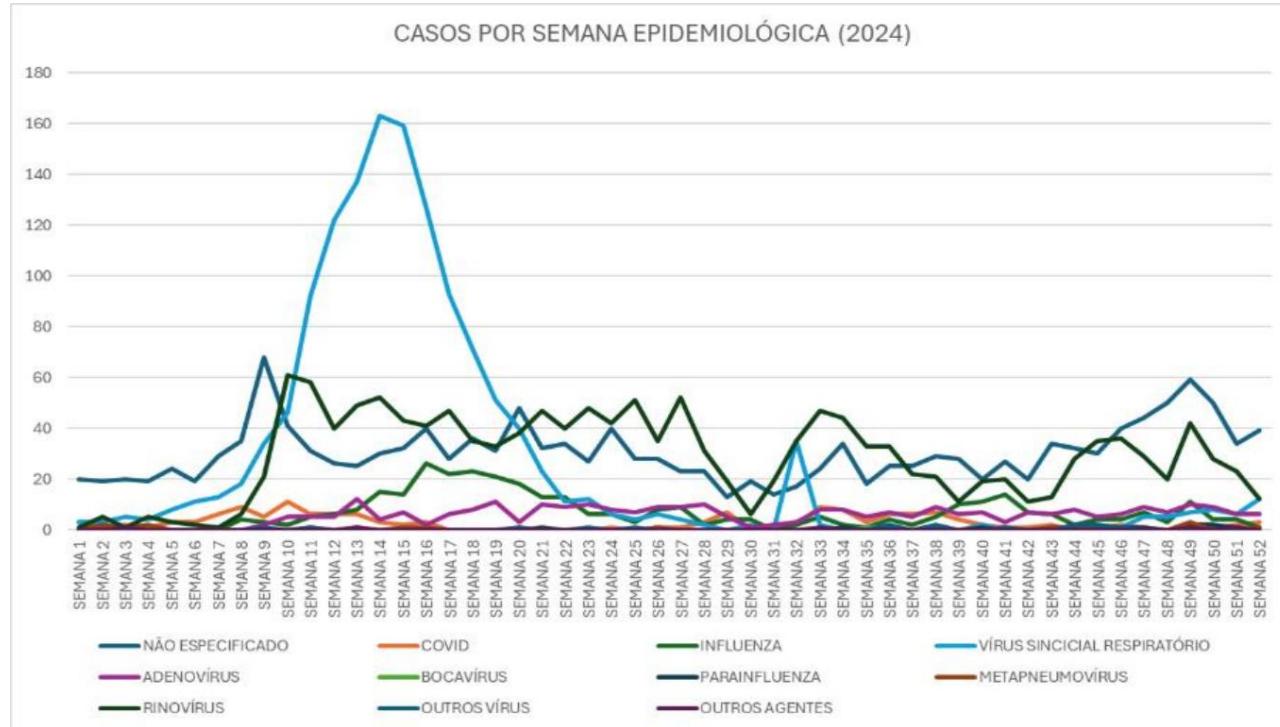
Influenza viruses were less frequent, suggesting a smaller relative impact of these viruses on mortality.

pediatric care during the analyzed period.

Analysis of the temporal distribution demonstrated a well-defined seasonal pattern. It was observed progressive increase in the number of cases starting from epidemiological week 8, with a peak between Weeks 10 and 16. This period coincided with increased RSV circulation, suggesting a strong association between this agent and the global increase in cases. After the peak, there was a gradual reduction in the number of notifications, maintaining intermediate levels throughout the second half of the year. In the final weeks Throughout the year, a slight proportional increase in cases associated with influenza was observed, consistent with its late seasonal pattern.

The weekly distribution of deaths largely followed the increase in the number of cases, mainly concentrated during the period of greatest viral circulation. However, some Deaths occurred in isolated incidents throughout the year, including in weeks with lower numbers. absolute number of cases, which suggests the influence of individual factors, such as comorbidities and young age. and delays in accessing health services.





In the year 2025, 6,400 cases of viral respiratory infections were reported, with male predominance (3,620; 56.6%) compared to female (2,780; 43.4%).

The age distribution showed a higher concentration of cases in children under 2 years old, which accounted for 60.5% ($n = 3,871$) of the total, followed by the group aged 2 to 10 years ($n = 2,273$; 35.5%) and by adolescents aged 11 to 19 years ($n = 256$; 4.0%).

Regarding the etiology, among children under 2 years old, respiratory syncytial virus stood out. RSV ($n = 1,469$) and rhinovirus ($n = 1,103$) were identified as the most frequently identified agents. A similar pattern was observed in the 2 to 10 year old group, in which rhinovirus ($n = 879$) and RSV ($n = 316$) predominated. Among adolescents, rhinovirus remained the main agent. identified ($n = 66$).

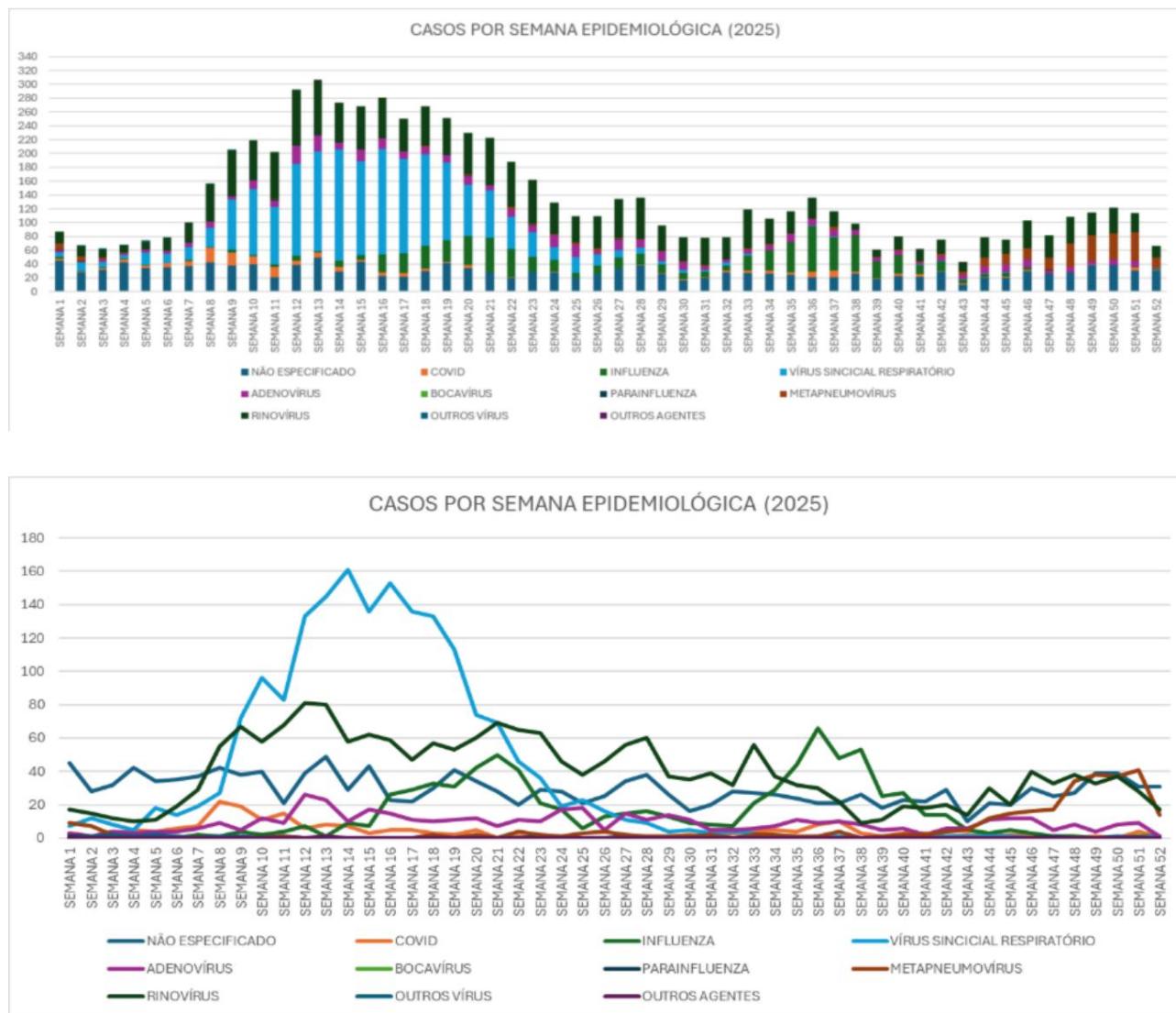
Influenza showed a higher relative frequency starting from 2 years of age, with an increase progressive in older age groups, while COVID-19 represented a reduced proportion. of the cases in all groups analyzed.

Twenty-five deaths were recorded during the study period, of which 60% ($n = 15$) occurred in children under 2 years old. Most deaths were associated with RSV and rhinovirus, while Influenza and COVID-19 contributed to a smaller absolute number of deaths.

Analysis by epidemiological weeks revealed a seasonal pattern, with a gradual increase in cases starting from the 8th week, peaking between the 12th and 18th weeks, a period characterized by Predominance of RSV. From the 20th week onwards, a reduction in cases caused by other viruses was observed and There was a relative increase in influenza, especially up to the 38th week. In the final weeks of the year, there was a new...

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Predominantly rhinoviruses and metapneumoviruses, with less circulation of influenza and COVID-19.



During the period analyzed, an increase in the total number of infection cases was observed.

Respiratory viral cases are projected to increase from 4,900 in 2024 to 6,400 in 2025, representing a 30.6% increase.

In both years, there was a predominance of males, maintaining the same proportion.

similar between periods. In 2024, male cases accounted for 55.0% (n = 2,696).

while in 2025 they represented 56.6% (n = 3,620).

The age distribution maintained a similar pattern in both years, with a higher concentration of cases in children under 2 years old, although with a proportional reduction in 2025. In 2024, this age group accounted for 63.4% of cases (n = 3,108), while in 2025 it represented 60.5% (n = 3,871). A proportional increase was observed in the 2 to 10 year age group, which rose from 33.0% in 2024 (n = 1,618) to 35.5% in 2025 (n = 2,273). The 11-19 age group remained low relative participation in both years.

Regarding etiology, there was a slight absolute increase in 2025. Respiratory syncytial virus (RSV) and rhinovirus were the most frequently identified agents in both years, especially

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Among children under 2 years old. An absolute increase in cases associated with RSV was observed in 2025.

accompanied by the maintenance of high circulation of rhinovirus across all age groups.

Influenza showed a higher relative frequency in 2025, particularly from the age of 2 onwards.

age, maintaining a similar seasonal pattern between years. COVID-19 remained with

Reduced participation in both periods, although with a slight absolute increase in 2025.

following the overall growth in the number of notifications.

There were 19 deaths recorded in 2024 and 25 deaths in 2025, representing an absolute increase.

31.6%. In both years, deaths were predominantly concentrated among younger children.

Two-year-olds accounted for 89.5% of deaths in 2024 (n = 17) and 60.0% in 2025 (n = 15). The main

The etiology associated with deaths in both periods was primarily RSV and rhinovirus.

The temporal analysis by epidemiological weeks demonstrated a similar seasonal pattern in two years, with a concentration of cases in the first semester, especially between weeks 10 and 18, a period marked by the predominance of RSV. In 2025, a greater magnitude of the peak was observed. seasonal increase compared to 2024, in addition to a greater relative share of influenza in the second semester.

The Federal District follows the parameters of the National Immunization Program (PNI), with targets of 95%. for most vaccines (including influenza and COVID-19); however, these levels were not targets for influenza and COVID-19 among children and adolescents in 2024 and 2025

Age range (years)	Influenza – Vaccination coverage	COVID-19 – Vaccination coverage
6 months – 2 years	Low coverage (<60%)	D1–D3: ~27.7% – 9.2%
3-4 years	Low coverage (<60%)	D1–D3: ~35.7% – 8.9%
5-11 years	Not specified	D1: ~74.4%; D2: ~57.7%; Reinforcement: ~14.6%

An official publication from the Health Department of the Federal District indicates that, after the inclusion Regarding the inclusion of the COVID-19 vaccine in the routine childhood immunization schedule, coverage rates in 2024 fell short of targets. at various ages:

- 6 months to 2 years: low coverage per dose (D1 ~27.7%; D2 ~17.8%; D3 ~9.2%).
- 3 to 4 years: greater coverage, but still insufficient (D1 ~35.7%; D2 ~22.4%; D3 ~8.9%).
- Between 5 and 11 years of age, the rates were higher for the first doses (D1 ~74.4%; D2 ~57.7%) with low reinforcement (~14.6%).

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This data refers to childhood vaccination by specific age group in 2024.

The same 2024 bulletin also mentioned influenza vaccination coverage.

The children's rate was below target, highlighting an overall percentage of less than 60% in the children's age group. without breaking it down by age in more detail.

An analysis of influenza and COVID-19 vaccination coverage across different age groups.

Pediatric studies show significant heterogeneity and, in general, insufficient levels of protection. especially in younger age groups.

In the 6-month to 2-year age group, low influenza vaccination coverage is observed, lower than at 60%, a value considered below the recommended level for collective protection. Regarding COVID-19, coverage of primary doses (D1 to D3) was extremely low, ranging

approximately between 27.7% and 9.2%, which indicates a high proportion of infants susceptible to infection and serious outcomes. This finding is particularly relevant considering that children

Children under two years old have the highest risk of hospitalization and death from respiratory infections. viral.

Among children aged 3 to 4 years, the observed pattern was similar. Vaccination coverage against Influenza vaccination rates remained below 60%, while COVID-19 vaccination rates showed higher percentages. Slightly higher than those observed in children under two years of age, but still insufficient.

Coverage rates for doses D1 to D3 ranged from 35.7% to 8.9%, revealing a progressive decline in adherence. to the complete vaccination schedule, a phenomenon consistent with vaccine abandonment throughout the doses. subsequent.

In the 5 to 11 year age group, there was no specification of influenza vaccination coverage.

This may indicate limitations in record-keeping or a lack of data consolidation for this group.

In contrast, COVID-19 vaccination showed better relative performance, with

Coverage of the first dose (D1) was around 74.4%, and of the second dose (D2) was 57.7%. However, the Booster dose coverage remained low (~14.6%), highlighting difficulties in maintenance. of immunization over time.

Overall, the data indicate suboptimal vaccination coverage across all age groups. analyzed, with greater severity in children under five years of age. Low adherence to booster doses, especially for COVID-19, it suggests weaknesses in communication, access and strategies.

The continuation of vaccination campaigns. This scenario may contribute to greater viral circulation. increased incidence of respiratory infections and greater pressure on health services, especially during seasonal periods of higher transmission.

Final Considerations

The findings of this study show that children under 5 years old are the most affected population. vulnerable to respiratory infections in the Federal District, confirming results from national and international studies. The temporal pattern of influenza followed the expected pattern, with peaks in winter, while COVID-19 Intermittent circulation persisted, reflecting the post-pandemic endemic phase.

The reduction in vaccination coverage in 2025, especially in age groups above 5 years, is This is concerning and may be related to:

- Impacts of the pandemic on vaccine confidence.
- Difficulties in accessing vaccination centers.
- Low-risk perception on the part of adolescent caregivers.

This drop in coverage may partially explain the maintenance of the incidence of cases. even in the context of available immunization. Furthermore, the study shows that data Data stratified by age are still limited, highlighting gaps in surveillance and data collection. Detailed information.

The results reinforce the need for:

- Vaccination campaigns targeted at teenagers.
- Communication strategies regarding the importance of ongoing immunization.
- Strengthening laboratory surveillance to identify new seasonal patterns.

Limitations of the study include:

- Use of secondary data, subject to underreporting.
- Possible underestimation of actual vaccination coverage due to delays in registration.
- Lack of detailed clinical data for all cases.

Despite this, the study provides valuable information for public policy and planning.

Immunization campaigns in the post-pandemic context.

An analysis of the temporal pattern of IRVs and vaccination coverage against influenza and COVID-19. In cases involving minors under 19 years of age in the Federal District, the evidence showed:

- Greater vulnerability in children under 5 years old.
- Consistent seasonal peaks for influenza and intermittent circulation of COVID-19.
- Reduced vaccination coverage among school-age children and adolescents, reinforcing gaps in immune protection.

It is essential to strengthen vaccination campaigns and improve epidemiological surveillance. stratified by age and adopt educational strategies to reduce vaccine hesitancy and increase Adherence across the entire pediatric age range.

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