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# High incidence of pneumonia cases observed in children seen in general practice consultations during the 2023–2024 season, France

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## Abstract

**Background** An increase in hospitalizations for respiratory illnesses due to *Mycoplasma pneumoniae* was reported in France in late October 2023. Data in primary care are scarce and microbiological or radiological investigations are not routinely recommended for community-acquired pneumonia.

**Methods** We computed weekly incidence rates of pneumonia and bronchiolitis cases from the electronic records of French general practitioners from January 2016 to August 2024. These weekly incidences were described in the light of the Covid-19 pandemic, overall and by age group. For better interpretation, the weekly incidences of pneumonia and bronchiolitis were compared with virological surveillance data of acute respiratory infections observed in general practice.

**Results** During the 2016–2024 period, 108,539 cases of pneumonia and 46,411 cases of bronchiolitis were identified from 51,351,414 consultations. The incidence of pneumonia consultations in general practice during the 2022–2023 and 2023–2024 seasons is similar to that observed before the Covid-19 pandemic, after two seasons of low incidence (2020–2021 and 2021–2022). However, the 2023–2024 pneumonia epidemic is the strongest ever observed in children (0–14 years, and especially among the 5–14 years) in general practice since 2016, with an earlier onset. Regarding the incidence of bronchiolitis in children, the 2023–2024 season was in line with the 2021–2022, 2022–2023 and pre-pandemic seasons. No abnormal circulation of classical seasonal viruses was observed during the 2023–2024 season.

**Conclusions** The sharp increase in pneumonia cases observed this season among children in primary care settings requires the implementation of studies to understand the cause and to confirm or refute the possible association with *M. pneumoniae* as observed in hospitals. Given the impact of the Covid-19 pandemic on the circulation of pathogens, it would be useful to extend, even on a temporary basis, the traditional microbiological surveillance in primary

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care to include common bacterial pathogens affecting the upper and lower respiratory tract, such as *M. pneumoniae*, *S. pneumoniae* or *Streptococcus A*.

## Background

In 2020 and 2021, Covid-19 non-pharmaceutical interventions (NPIs), such as mask use, significantly reduced the circulation of several respiratory pathogens worldwide, including influenza, respiratory syncytial virus (RSV), and *Mycoplasma pneumoniae* [1–3]. Relaxation of these NPIs has led to a resurgence of community-acquired infections, sometimes exceeding pre-pandemic levels, especially in children [4].

In late November 2023, health authorities reported a surge in outpatient consultations and hospital admissions for respiratory illness in children in northern China, due to *M. pneumoniae* since May 2023 and respiratory viruses (RSV, adenovirus, influenza) since October 2023 [5]. Similar trends have been reported in some Asian and European countries [6]. By early December, six European countries (Denmark, France, Ireland, the Netherlands, Norway, Sweden) reported a notable increase in *M. pneumoniae* respiratory disease in all age groups, but predominantly in children and adolescents, reaching levels similar to or higher than those observed before the Covid-19 pandemic [7].

French health authorities have also reported a surge in hospitalizations for respiratory infections caused by *M. pneumoniae* since the end of the summer 2023, more marked since October 2023, leading to an epidemic situation [8]. The increase in pneumonia hospitalizations was mainly observed in children aged 6 to 15 years and young adults aged 16 to 49 years [8]. In France, microbiological or radiological investigations are not recommended for community-acquired pneumonia in the outpatient setting, and diagnosis is based primarily on clinical features. As a result, the pathogen responsible for pneumonia is not routinely identified in primary care and general practice, in contrast to hospitals where diagnostic testing is more systematic. Although viral pneumoniae are the most common, bacterial agents such as *Streptococcus pneumoniae* and *M. pneumoniae* are often involved in acute community-acquired pneumonia (accounting for up to 50% of cases in both children and young adults) [3, 9].

In this context, we aimed to use existing surveillance systems in primary care to estimate the incidence and temporality of pneumonia (categorized by age groups) and bronchiolitis (in children only) seen in general practice consultations between January 2016 and August 2024 in France. Without microbiological confirmation of these pneumonia in general practice, we analyzed data

from the French virological surveillance to identify the circulating respiratory viruses during the 2023–2024 season, and better understand the signals obtained.

## Methods

### Calculating the weekly incidence of pneumonia and bronchiolitis in general practice consultations

We used data collected from IQVIA's Electronic Medical Records (EMR) database. This database aggregates data from a representative sample (based on age, sex, and geographic distribution) of approximately 1,200 general practitioners (GPs) in France (approximately 2% of all French GPs). Patient demographics are consistent with national statistics.

For each pneumonia and bronchiolitis general practice consultation between January 2016 and August 2024, we extracted the following anonymized data: patient sex and age, and diagnosis coded according to the ICD-10. We identified pneumonia consultations using the following ICD-10 codes: J189 (pneumonia, not specified), J180 (bronchopneumopathy, not specified), J188 (other pneumonia, not specified), J129 (viral pneumonia, not specified), and J121 (pneumonia due to RSV). We identified bronchiolitis consultations using the ICD-10 code J219 (bronchiolitis, not specified), the only ICD-10 code used and available in the IQVIA EMR database for bronchiolitis.

In the absence of a mandatory practice registry in France, the size of the population covered by each GP is unknown. We estimated the total number of pneumonia and bronchiolitis cases per week (weekly incidence) by first determining the mean number of pneumonia and bronchiolitis cases reported per participating GP for a given week and then extrapolating this to the total number of practicing GPs. To account for regional differences in GPs density, we first estimated the weekly incidence at the regional level, and then summed these figures to obtain national estimates. Incidence rates (per 100 000 population) were obtained by dividing the estimated incidences by the population size, based on census data. Age-specific pneumonia incidence rates were estimated for the following age groups: 0–4 years, 5–14 years, 0–14 years, 15–44 years, 45–64 years, 65 years and older. Age-specific bronchiolitis incidence rates were estimated for children only, based on four age categories: less than 2 years, 2–4 years, 5–14 years, 0–14 years. Confidence intervals were estimated assuming that cases reported by

GPs follow a Poisson distribution. The incidence of pneumonia and bronchiolitis for the 2023–2024 season was compared with the pre- and post-pandemic seasons.

### Weekly circulation of respiratory viruses observed in general practice

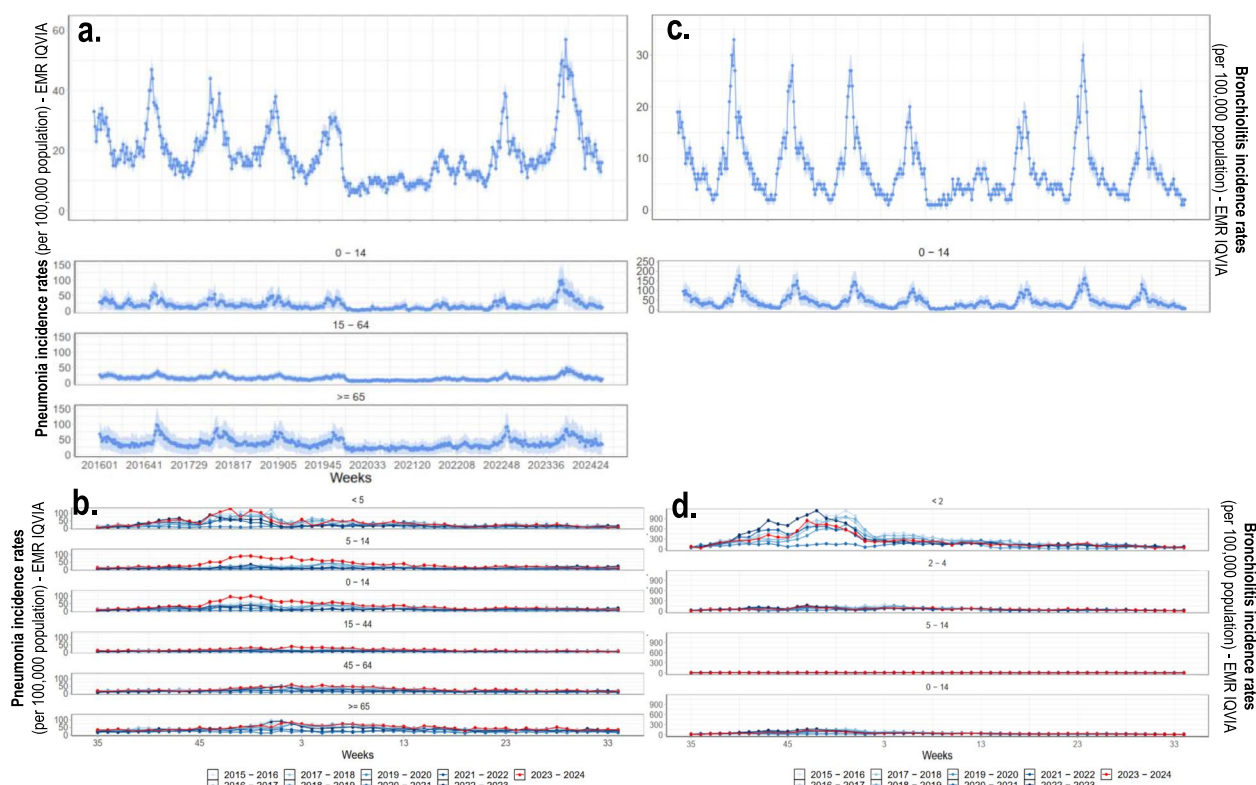
To describe the circulation of seasonal respiratory viruses observed in general practice, we used the database of the French Sentinelles network. The virological surveillance performed by this network in primary care is based on nearly 300 GPs and pediatricians who randomly sample patients presenting with an acute respiratory infection (ARI) each week from late September to mid-April [10]. Weekly positivity rates for the following respiratory viruses were collected: influenza viruses; SARS-CoV-2; RSV; human rhinovirus (hRV); human metapneumovirus (hMPV).

## Results

### Weekly incidence of pneumonia in general practice consultations, overall and by age group

During the period 2016–2024, 108,539 cases of pneumonia were identified from 51,351,414 general practice consultations. Figure 1a shows the weekly incidence rates of pneumonia consultations in general practice between the first week of 2016 (2016w01) and the week 34 of 2024 (2024w34), according to the ISO 8601 standard. Before the Covid-19 pandemic, the incidence of pneumonia consultations ranged from 10 (spring/summer) to 47 (autumn/winter) cases per 100,000 population, with an average peak incidence of 39 cases per 100,000 population. During the pandemic (2020–2022), rates dropped below 10 (spring/summer) and 20 (autumn/winter) cases per 100,000 population. After the pandemic (2022–2023), rates returned to pre-pandemic levels. The highest pre-pandemic rates were in the 65+ age group.

In 2023–2024, the overall rates and trends were similar to 2022–2023 and pre-pandemic levels, but peaked at 57 (95%CI [52; 62]) cases per 100,000 population in the



**Fig. 1** **a** Weekly incidence rates of pneumonia consultations in general practice (per 100,000 population), overall and by age group (0–14; 15–64; 65+); **b** Weekly incidence rates of pneumonia consultations in general practice for the 2023–2024 season (in red) compared with historical data since 2015–2016 (in blue) by age group (<5; 5–14; 0–14; 15–44; 45–64; 65+); **c** Weekly incidence rates of bronchiolitis consultations in general practice (per 100,000 population), overall and in the 0–14 age group; **d** Weekly incidence rates of bronchiolitis consultations in general practice for the 2023–2024 season (in red) compared to historical data since 2015–2016 (in blue) by age groups (<2; 2–4; 5–14; 0–14), IQVIA's EMR database from week 1 of 2016 to week 34 of 2024 in France

second week of January (2024w02), which was higher than the previous highest peak of 47 [43; 51] cases per 100,000 population observed in 2016w52. Focusing on age groups, high incidence was observed in 2023–2024 in each age group (children and adults) compared to previous seasons. However, an exceptionally high incidence was observed in the 0–14 years (especially in the 5–14 years), reaching 96 [83; 109] cases per 100,000 population in 2023w50, exceeding the previous highest peak of 63 [53; 73] cases per 100,000 population in 2016w49. Moreover, the onset of increased incidence rates in 2023–2024 was earlier than in previous years, with a notable increase in cases among children starting in early November 2023, peaking in late December (2023w50), and finally declining since then (Fig. 1b). In contrast, incidence rates in the 15–44, 45–64 and 65+ age groups continued to increase until mid-January (2024w02) and seemed to decrease slowly from 2024w03 onwards.

#### Weekly incidence of bronchiolitis in children observed in general practice consultations

During the period 2016–2024, 46,411 cases of bronchiolitis were identified from the 51,351,414 general practice consultations. The weekly incidence rates of bronchiolitis observed in the 2023–2024 season in children under 2 years of age and more globally in the 0–14 age group had the same trend as the 2021–2022 and 2022–2023 bronchiolitis epidemics, with lower intensity, and was in line with pre-pandemic rates (Fig. 1c and d).

#### Circulation of respiratory viruses during the 2023–2024 season in children

The circulating viruses observed during the 2023–2024 season in children presenting to primary care with

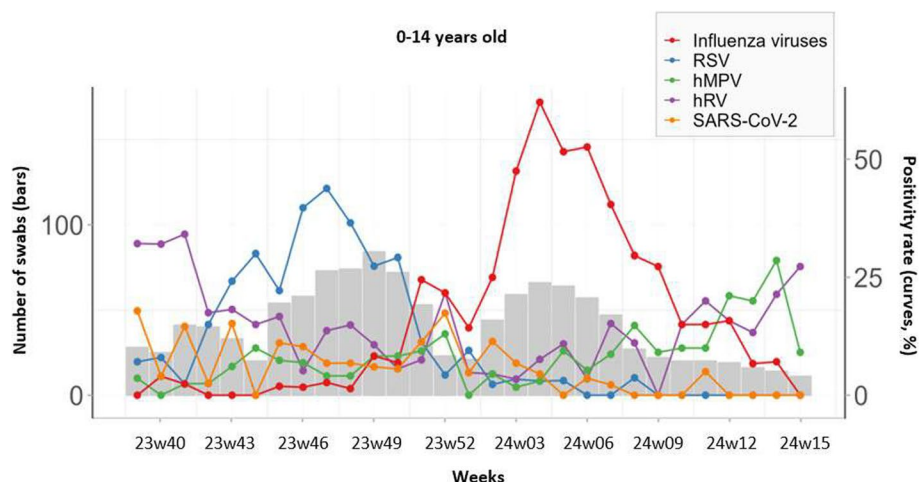
respiratory symptoms were mainly RSV (with an epidemic circulation from 2023w43 to 2023w50) and influenza viruses (from 2023w51 to 2024w12) (Fig. 2). During the first weeks of the increased incidence of pneumonia in children, starting in 2023w45, they were mainly RSV.

#### Discussion

The incidence of pneumonia consultations in general practice during the 2022–2023 and 2023–2024 seasons is similar to that observed before the Covid-19 pandemic, after two seasons of low incidence (2020–2021 and 2021–2022). This pattern has also been observed in other countries [2]. However, the 2023–2024 epidemic is the strongest ever observed in children (0–14 age group, and especially among the 5–14 years old) in general practice since 2016, with an earlier onset compared to previous years.

A leading hypothesis is that an “immunity debt” among children, resulting from reduced exposure to pathogens due to NPIs during the pandemic, contributed to the increase in pediatric pneumonia cases [4, 7].

A first limitation of our work is the lack of microbiological data in general practice to identify the pathogens responsible for this increase in pneumonia consultations in children (0–14 years old), and therefore it is not possible to directly complement the presented data with information on *M. pneumoniae*, as there is no specific surveillance system for this pathogen in France. However, this increase cannot be linked solely to the circulation of the respiratory viruses usually observed, nor to the incidence of bronchiolitis observed in 2023–2024. In fact, the 2023–2024 primary care surveillance data showed an increase in both RSV circulation and weekly bronchiolitis incidence (with RSV accounting for 60–80% of



**Fig. 2** Number of swabs (bars) and positivity rates (curves) of respiratory viruses tested in patients aged 0–14 years presenting with an acute respiratory infection and swabbed by Sentinelles physicians (GPs and pediatricians) from week 39 of 2023 to week 15 of 2024 in France

bronchiolitis presentations [11]), concomitant with the increase in pneumonia cases observed in children, but without any unusual impact in this age group (both for virological data and bronchiolitis incidence) or in any other child age groups regarding bronchiolitis incidence (i.e. <2, 2–4 or 5–14). In addition, no significant increases in the circulation of hRV, SARS-CoV-2, hMPV or influenza viruses were observed in children during the same period compared with previous seasons. The 2023–2024 influenza epidemic occurred later in the season, well after the increase observed in pneumonia cases. Based on the concurrent increase in hospitalizations for *M. pneumoniae* infections and the increase in pneumonia hospitalizations (all types) observed in children and young adults, the involvement of *M. pneumoniae* is a likely hypothesis. Knowing that *M. pneumoniae* mainly affects children, their disproportionate involvement in the observed trends of general practice consultations could support this hypothesis. Especially since the increase in pneumonia incidence observed in our data is mainly observed in the 5–14 years, but also to a lesser extent in young adults aged 15–44 years, as for the French hospital data [8].

Another limitation of our study is the lack of a standardized clinical case definition for pneumonia consultations in general practice [12]. However, because the operating protocol of the IQVIA EMR database has remained consistent since its implementation, we can assume that the observed trends are unrelated to changes in diagnostic coding practices.

## Conclusion

The sharp increase in pneumonia cases observed during the 2023–2024 season in children attending primary care requires the urgent implementation of studies to understand the cause and confirm or refute the possible association with *M. pneumoniae*.

In France, respiratory surveillance in primary care focuses on clinical surveillance of acute respiratory infections, complemented by virological surveillance of common respiratory viruses. In view of the Covid-19 pandemic and its impact on the circulation of pathogens, it would be useful to extend the microbiological surveillance in primary care to common bacterial pathogens of the upper and lower respiratory tract, such as *M. pneumoniae*, *S. pneumoniae* or *Streptococcus A*, even temporarily.

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## Authors' contributions

CG, OS, TH, TB designed the study. TL, CG, TB performed the statistical analyses. CG, OS, TH, TB interpreted the results. CG wrote the draft of the manuscript. CG, OS, TL, IB, DV, MF, AR, JLB, LR, RP, FG, AB, IPDC, TH, TB reviewed the manuscript.

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## Data availability

The data that support the findings of this study are available from IQVIA but restrictions apply to the availability of these data, and so are not publicly available. Data are however available from the authors upon reasonable request and with permission of IQVIA.

## Declarations

### Ethics approval and consent to participate

The IQVIA electronic medical records (EMR) database represents aggregated data that are extracted anonymously from GPs EMR (for sex, age and ICD-10 codes only). This study was then performed on anonymous data without any way to identify patients. For this kind of studies, under French law, consent of the patients is not needed. Regarding the virological data, the protocol was conducted in agreement with the Helsinki declaration. We obtained authorization from the French Data Protection Agency (CNIL#471393) and the French ethical research committee (Comité de protection des personnes).

### Consent for publication

Not applicable.

### Competing interests

The authors declare no competing interests.

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