

Trend of respiratory pathogens during the COVID-19 epidemic: comparison between 2020 and the last 5 years

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Short report

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Abstract

In China, the first SARS-CoV-2 infection was diagnosed in Wuhan on December 8. Spreads in other regions have occurred since the end of January, happens to be the start of Lunar New Year holiday. In this study, we analyzed the prevalence of common respiratory pathogens in children with respiratory infections during the SARS-CoV-2 pandemic and compared them with the time trends from 2016 to 2019. Overall, results obtained indicate that the time trend of other respiratory infections were significantly different from previous years, especially the pattern of influenza and *Mycoplasma pneumoniae*. Therefore, in the current scenario of COVID-19 pandemic, other common pathogens testing should not be excluded. The natural home isolation period in new year holiday may weaken the transmission of common respiratory viruses.

Introduction

The pandemic caused by the severe acute respiratory syndrome Coronavirus-2 (SARS-CoV-2) has attracted global concern because it spreads rapidly in many countries with fatal progression (1; 2). In China, the first SARS-CoV-2 infection was diagnosed in Wuhan on December 8, 2019. Since January 16, the emergency response level of Chinese Center for Disease Control and Prevention has been ungraded to Level 1 (the highest level) in Wuhan, followed by progressive rapid spread to all other areas of the nation. Since the end of January, most provinces have initiated Level-1 response (1). This SARS-CoV-2 outbreak happened in Lunar New Year holiday(week 3–4 of 2020), which is a natural period for home isolation. In addition, due to this epidemic, the school opening time was postponed for 4 months until June.

Since the epidemic period of SARS-CoV-2 happens to be the winter peak of influenza and other respiratory pathogens, it is unclear whether the isolation policy will affect the time trend of other respiratory infections in our region. This article will summarize the prevalence of other respiratory pathogens from January to April 2020 and compare it with the data for the same period in 2016–2019.

Methods

From January 1 to April 19, 2020, 2,183 sputum specimens were subjected to multiplex-PCR testing (ResP 13 Kit, Ningbo Health Gene Tech Co., Ltd., China) for the detection of common respiratory pathogens, including Influenza A/B, Parainfluenza, non-SARS-Coronaviruses, Respiratory Syncytial virus, Adenovirus, Human Metapneumovirus, Rhinovirus/Enterovirus, Bocavirus, *Mycoplasma pneumoniae* and *Chlamydia*. In this report, the time distribution of positive respiratory pathogens during SARS-CoV-2 epidemic and the same period in 2016–2019 are described.

Results

The time trend of respiratory pathogens was analyzed by dividing the study period into 2 weeks. A total of 11 types of pathogens are separated into 4 groups, which are non-SARS-coronaviruses, FluA and FluB,

atypical bacteria (*M. pneumoniae* and *Chlamydia*) and other viruses. The frequency of FluA/B and non-SARS-coronaviruses decreased and reached 0% thereafter. At weeks 3–4, the peak frequency observed in the other viruses' group was 89%, followed by a progressive decline (Fig. 1E). The total number of samples tested also showed this decreasing pattern. In contrast, within the same time interval, the positive detection rate of atypical bacteria increased rapidly, 20% at weeks 3–4, peak at weeks 9–10 as 44%, and at weeks 15–16 fell to 9%. This pattern is completely different from previous years.

Comparing the 2016–2019 data with the distribution in the same period of 2020, we found that the FluA/B group showed a rapid upward trend in the first 4 weeks of 2017–2019, and then gradually declined (Fig. 1). In 2016, the frequency rose to 60% within weeks 1–8, and then fell back to 4% at week 9, of which FluB accounted for a large proportion (Fig. 2). However, the pattern of 2016–2019 is quite different from that of 2020, which maintained a downward trend without any peak.

Non-SARS-coronaviruses were distributed steadily during the 2016–2019 observation period. In addition to rising to 10% in weeks 11–16 of 2017, the positive rates in 2016, 2018 and 2019 remained below 5%. While in 2020, especially after week 9, there are basically no positive specimens.

The positive detection rates of *M. pneumoniae* and *Chlamydia* in the observation period of 2016–2019 were steadily distributed between 5%-15%. However, in 2020, when the positive rates of all other viruses began to decrease, the positive rates of *M. pneumoniae* and *Chlamydia* increase and reach a peak of 44% in 10th week.

The positive rates of other pathogens remained at around 80% in the first 16 weeks of 2016–2019, while in 2020, it fell from 89% to less than 20%.

By comparing each pathogen separately, we found that the following pathogens distribution trends in 2020 are significantly different from other years, including HRV, *M. pneumoniae*, HPIV, HMPV, FluA and HCoV, while the trends of RSV, FluB, AdV, *Chlamydia*, HBoV are similar among these five years (Fig. 2).

Discussion

Overall, these findings indicated that measures to prevent or reduce transmission of the SARS-CoV-2 have substantially affected the time trend of other respiratory infections in our region. If the outbreak occurs after the New Year's holiday, the large movement of people may cause larger spread of SARS-CoV-2 as well as other respiratory viruses.

During the 2019-nCoV transmission, more than half of the adult patients with acute respiratory tract infection in Beijing (3) and Rome (4) were infected with non-SARS-CoV-2 pathogens, such as influenza A virus. However, the detection targets of these studies do not include atypical bacteria such as *Mycoplasma pneumoniae*, so we cannot obtain its prevalence in adults. It has been repeatedly observed that the incidence of *M. pneumoniae* in adults is lower than the burden of children (5; 6). Transmission rate among family indicates that children may act as a reservoir and maintain contagiousness for a long

period of time ranging from months to years (7). This maybe the reason why the positive rate of *M. pneumoniae* was still high while the positive rates of other pathogens were declining in 2020.

In fact, there are no specific symptoms that can help distinguish COVID-19 from other respiratory infections (8), and the presence of non-SARS-CoV-2 pathogen may not guarantee that patient do not have SARS-CoV-2 (9). Although COVID-19 should be taken seriously, respiratory infections caused by other pathogens, especially influenza or atypical bacteria, should not be ignored, especially the SARS-CoV-2 epidemic was coincident with the winter peak of influenza and other respiratory pathogens.

Conclusion

Overall, results obtained indicate that the time trend of other respiratory infections are significantly different from previous years, especially the pattern of influenza and *Mycoplasma pneumoniae*, highlighting that the detection of other common respiratory pathogen(s) should not be ignored during the SARS-CoV-2 pandemic.

Declarations

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Authors' contributions

LW and GXL designed the study and take responsibility for the entire process; SY and ZSF conducted literature search, data extraction, quality assessment and draft writing; XTY, TL and MCZ collected and analyzed the data. All authors have read and approved the final paper.

Availability of data and materials

The datasets generated and/or analyzed during the current study are available in the Figshare repository (https://figshare.com/articles/dataset/AccessibleData_xlsx/12630038).

Ethics approval and consent to participate

The study was approved by the Children's hospital Hebei Province Ethics Committee (number 2018002). The legal guardian(s) or parent(s) of the children provided written informed consent for sample collection and clinical record review.

Consent for publication

Not applicable.

Competing interests

The authors declare that they have no competing interests.

Abbreviations

RT, reverse transcription; HRV, human rhinovirus; RSV, respiratory syncytial virus; FluA, influenza A; HMPV, human metapneumovirus; HPIV, human parainfluenza virus; FluB, Influenza B; ADV, adenovirus; MP, *Mycoplasma pneumoniae*; HCoV, human coronavirus; HBoV, human bocavirus; Ch, Chlamydia.

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Figures

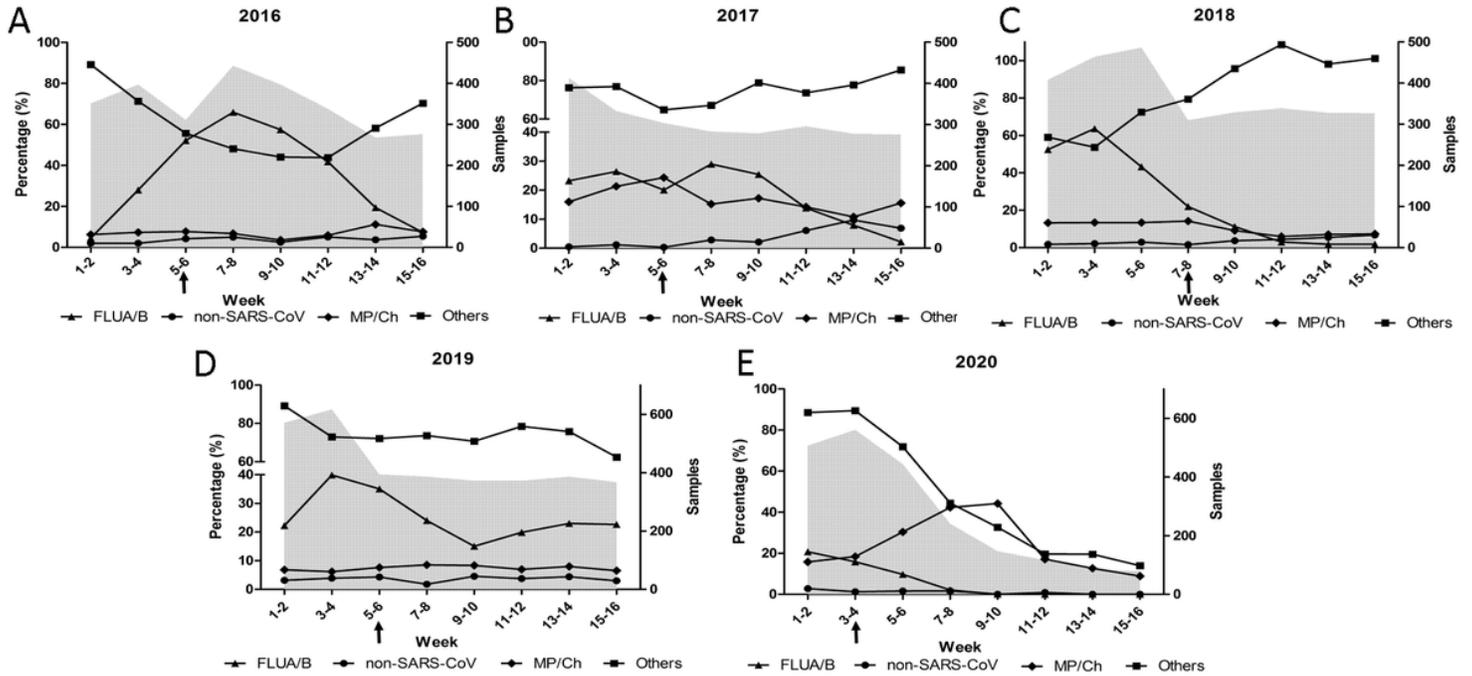


Figure 1

Trends of other respiratory pathogens positive specimens. Trend of common pathogens leading to respiratory tract infection from week 1 to week 16 of the 2016 to 2020 were shown in A-E. Trend of the positive specimens for Influenza A and B (▲), non-SARS-Coronaviruses (●), *M. pneumoniae* and *Chlamydia* (⊠) and the other respiratory pathogens (■) were expressed as percentage of positive sputum specimens; grey area represents the total number of tested samples.

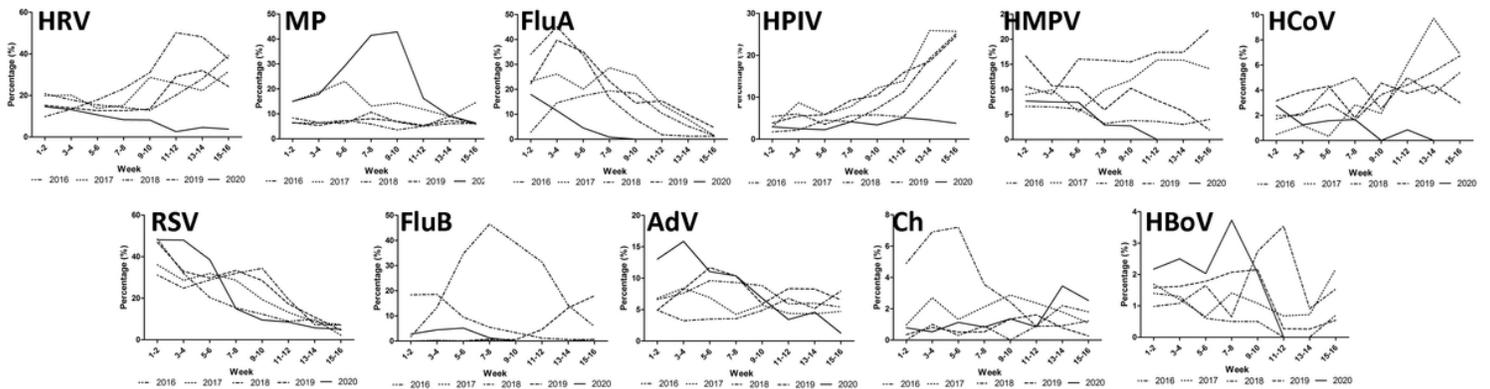


Figure 2

Comparing each pathogen separately through 2016-2020. Trend of 11 pathogens were shown between 2016 (---), 2017 (—), 2018 (---), 2019 (— —) and 2020 (—). Abbreviation: HRV, human rhinovirus; RSV, respiratory syncytial virus; FluA, influenza A; HMPV, human metapneumovirus; HPIV, human parainfluenza virus; FluB, Influenza B; ADV, adenovirus; MP, Mycoplasma pneumoniae; HCoV, human coronavirus; HBoV, human bocavirus; Ch, Chlamydia.