



Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

Elsevier hereby grants permission to make all its COVID-19-related research that is available on the COVID-19 resource centre - including this research content - immediately available in PubMed Central and other publicly funded repositories, such as the WHO COVID database with rights for unrestricted research re-use and analyses in any form or by any means with acknowledgement of the original source. These permissions are granted for free by Elsevier for as long as the COVID-19 resource centre remains active.



Contents lists available at ScienceDirect

## Journal of Infection

journal homepage: [www.elsevier.com/locate/jinf](http://www.elsevier.com/locate/jinf)

## Letter to the Editor

### Changes in Streptococcus pneumoniae infection in children before and after the COVID-19 pandemic in Zhengzhou, China



Dear editor,

The report entitled "Decreasing proportion of extended-spectrum beta-lactamase among *E. coli* infections during the COVID-19 pandemic in France" by Lemenan et al. attracted our intense attention and interest.<sup>1</sup> In this report, the authors found that the proportion of ultra-broad-spectrum  $\beta$ -lactamases in *E. coli* infections declined and the number of infections decreased after the lockdown. Here, we present the prevalence of Streptococcus pneumoniae among children during the COVID-19 pandemic in Zhengzhou, China.

*Streptococcus pneumoniae*, a gram-positive coccus, is widespread in nature. The main pathogenic substances include podococci, hemolysin and neuraminidase.<sup>2</sup> It is colonized in the nasopharynx of healthy people, with the highest colonization rate in children, and can be transmitted through droplets and direct contact.<sup>3,4</sup> Streptococcus pneumoniae infection is the most important pathogen causing meningitis, community-acquired pneumonia, and otitis media in children. In addition, invasive pneumococcal diseases (IPDs) are the leading cause of death in children under 5 years of age.<sup>5,6,7</sup> The World Health Organization (WHO) estimates that approximately 1.6 million children die each year from Streptococcus pneumoniae infectious diseases, including 700,000 to 1 million children under 5 years of age, most of whom are under 2 years of age.<sup>5</sup> With the widespread use of pneumococcal conjugate vaccine (PCV) in children in many countries and regions, the number of deaths among children from Streptococcus pneumoniae-related diseases has declined. In 2015, approximately 335,000 children under the age of 5 died of bacterial pneumonia caused by Streptococcus pneumoniae worldwide, and these children mainly lived in developing countries with no or low vaccination rates for PCV.<sup>5</sup> Therefore, the prevention and control of childhood Streptococcus pneumoniae disease is a major public health problem worldwide, especially in developing countries.

In this study, We compared the number of positive cases and percentage of positive of Streptococcus pneumoniae in children before and after COVID-19 pandemic to explore the epidemiological impact of the COVID-19 pandemic on Streptococcus pneumoniae. We analyzed the number of positive Streptococcus pneumoniae infections and calculated the positive detection rate (positive detected specimens/total specimens) (Fig.1), as well as the number of positive cases and percentage of positive of Streptococcus pneumoniae at different age stages (Fig.2), and found that the number of children with Streptococcus pneumoniae infections before and after the COVID-19 pandemic in Zhengzhou was significantly different.

The results of the data show that the number of children with Streptococcus pneumoniae infections and the positive detection rate were the lowest in 2020 and the highest in 2019 over the four years. Streptococcus pneumoniae infections in 2018 and 2019 before the pandemic had obvious seasonality, in which the positive detection rate was higher in winter from November to January, while the seasonality in 2020 and 2021 was not fully highlighted. In addition, the total number of infections in 2021 is slightly higher than in 2020, which may be related to the relative stability of the epidemic, the beginning of children's enrollment in nurseries and schools, the relative gathering of people and people's awareness of protection may decrease slightly after vaccination. In July 2021, the number of Streptococcus pneumoniae infections and the percentage of positive both decreased in the short term due to control measures taken in Zhengzhou after a brief rebound of the COVID-19 epidemic, which also indicates that the COVID-19 epidemic can indeed influence the infection status of Streptococcus pneumoniae.

In addition, we also found that whether the COVID-19 pandemic exists or not, the positive rate of Streptococcus pneumoniae detected in specimens of children under 2 years old was high and the number of positive samples accounted for more than 50% in total positive samples in that year, and the percentage of children under 5 years old is more than 80%, which also indicates that the population of Streptococcus pneumoniae infection is mainly under 5 years old, especially under 2 years old.

In short, the COVID-19 pandemic changed the epidemiological trend of Streptococcus pneumoniae infection in children in Zhengzhou. This change may be mainly related to a series of stringent measures taken during the COVID-19 pandemic. And people's awareness of self-protection and the protection taken have increased, which also reduced the chance of Streptococcus pneumoniae infection. Although COVID-19 is still occurring in some cities in China, it is generally under control, but the global pandemic is still ongoing and the situation of epidemic prevention and control remains critical. Therefore, the long-term epidemiological trend of Streptococcus pneumoniae in children deserves our continuous attention. In addition, the risk of Streptococcus pneumoniae infection should be noted in children under 5 years of age, especially under 2 years of age, and timely vaccination is an effective preventive measure.

In conclusion, Streptococcus pneumoniae infections among children are on a decreasing trend during the COVID-19 pandemic. Close monitoring of epidemiological trends can help prevent outbreaks of Streptococcus pneumoniae infection in children, especially those under 5 years of age, in the later stages of the epidemic and can provide a reference basis for developing prevention strategies for Streptococcus pneumoniae infection.

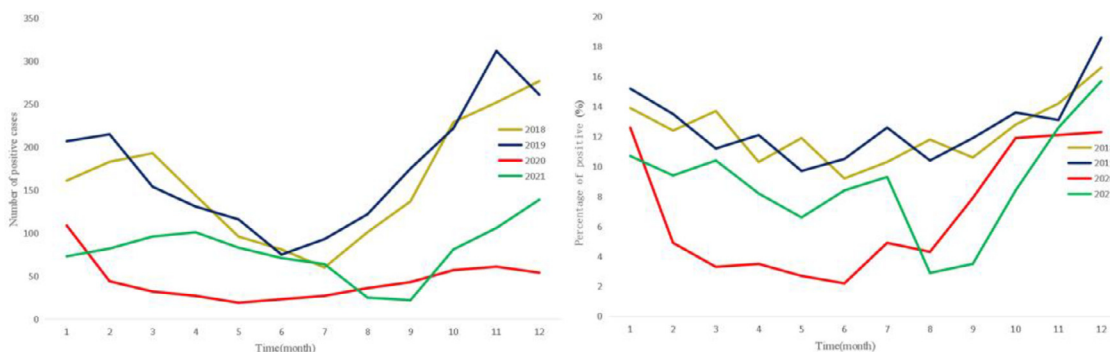


Fig. 1. The number of positive detections and the positive detection rate of *Streptococcus pneumoniae* at different times.

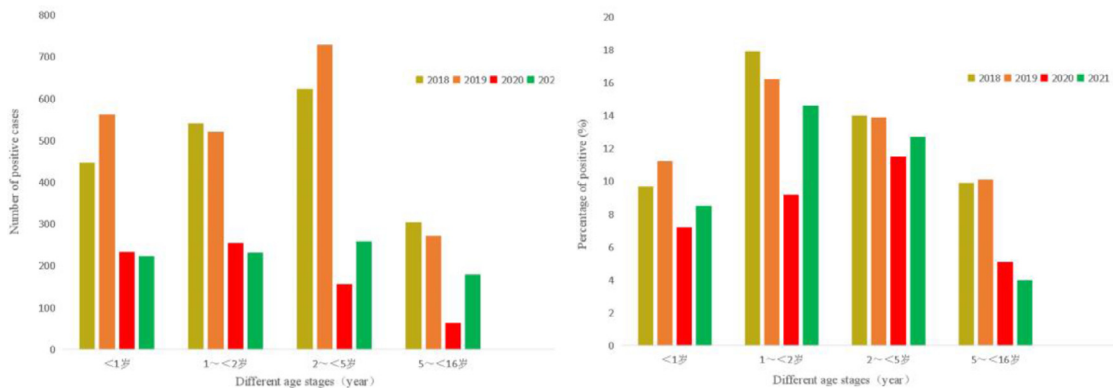


Fig. 2. The number of positive detections and the positive detection rate of *Streptococcus pneumoniae* at different age stages.

References

1. Lemenand O, Coeffic T, Thibaut S, Colomb Cotinat M, Caillon J, Birgand G. Decreasing proportion of extended-spectrum beta-lactamase among *E. coli* infections during the COVID-19 pandemic in France. *J Infect* 2021;**83**(6):664–70. doi:10.1016/j.jinf.2021.09.016.
2. Bogaert D, De Groot R, Hermans PW. *Streptococcus pneumoniae* colonisation: the key to pneumococcal disease. *Lancet Infect Dis* 2004;**4**(3):144–54. doi:10.1016/S1473-3099(04)00938-7.
3. Lee GM, Kleinman K, Pelton S, Lipsitch M, Huang SS. Immunization, antibiotic use, and pneumococcal colonization over a 15-year period. *Pediatrics* 2017;**140**(5):e20170001. doi:10.1542/peds.2017-0001.
4. Zintgraff J, Gagetti P, Napoli D, Sanchez Eluchans N, Irazu L, Moscoloni M, et al. Invasive *Streptococcus pneumoniae* isolates from pediatric population in Argentina for the period 2006–2019. Temporal progression of serotypes distribution and antibiotic resistance. *Vaccine* 2022;**40**(3):459–70. doi:10.1016/j.vaccine.2021.12.008.
5. Wahl B, O'Brien KL, Greenbaum A, Majumder A, Liu L, Chu Y, et al. Burden of *Streptococcus pneumoniae* and *Haemophilus influenzae* type b disease in children in the era of conjugate vaccines: global, regional, and national estimates for 2000–15. *Lancet Glob Health* 2018;**6**(7):e744–57. doi:10.1016/S2214-109X(18)30247-X.

6. Yan Z, Cui Y, Huang X, Lei S, Zhou W, Tong W. Molecular characterization based on whole-genome sequencing of *Streptococcus pneumoniae* in Children Living in Southwest China during 2017–2019. *Front Cell Infect Microbiol* 2021;**11**:726–40. doi:10.3389/fcimb.2021.726740.
7. Tvedskov ESF, Hovmand N, Benfield T, Tinggaard M. Pneumococcal carriage among children in low and lower-middle-income countries: a systematic review. *Int J Infect Dis* 2022;**115**:1–7. doi:10.1016/j.ijid.2021.11.021.

Yuanzhe Li\*, Yanjun Guo, Yongtao Duan  
 Department of Pediatrics, Children's Affiliated Hospital of Zhengzhou University, Zhengzhou, 450018, China

\*Corresponding author.  
 E-mail address: yuanzheedu@163.com (Y. Li)