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Letter to the Editor

Respiratory virus infections among hospitalized children aged 7 years and younger in Wuhan, China, 2017–2021

Dear Editor,

The report titled “Incident changes in the prevalence of respiratory virus among children during COVID-19 pandemic in Hangzhou, China” aroused our interest.¹ In this report, Han et al.¹ reported that the incidence of respiratory virus infections among pediatric outpatients decreased during the coronavirus disease (COVID-19) epidemic in Hangzhou, China and that the seasonality of infections was affected, but that the results might differ from those in other regions. Here, we report the epidemiological characteristics of respiratory virus infections among hospitalized children aged ≤ 7 years in Wuhan, China, the city at the epicenter of the COVID pandemic, from January 2017 to December 2021. The trends in respiratory virus infections in children in Wuhan, located approximately 750 km west of Hangzhou, were broadly similar to those reported in Hangzhou.

Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) was first detected in December 2019 in Wuhan.² Since then, SARS-CoV-2 has spread worldwide, causing the COVID-19 pandemic.³ Non-pharmaceutical interventions (NPIs) were implemented as control measures worldwide⁴ and reduced the transmission of SARS-CoV-2 and other respiratory pathogens.^{5,6}

Children were tested for five respiratory viruses (adenovirus [ADV], respiratory syncytial virus [RSV], influenza A [Flu A], influenza B [Flu B], and parainfluenza virus [PIV]) on admission to our hospital in Wuhan using a rapid antigen detection kit (Diagnostic Hybrids, Inc.). A total of 63,270 hospitalized children aged ≤ 7 years were tested for respiratory viruses between January 2017 and December 2021, of whom 37,722 (59.6%) were male and 25,548 (40.4%) were female. Their median age was 1 year (interquartile range [IQR]: 0.75–3 years). Among the children, 13,312 (21.0%) were positive for at least one respiratory virus (Supplementary Table 1), of which RSV (11.2%) was the most common, followed by PIV (5.9%), ADV (2.6%), Flu A (1.5%), and Flu B (0.7%) (Supplementary Tables 1 and 2). RSV was the predominant pathogen in all age groups. ADV and Flu B were detected mainly in children aged ≥ 1 year, whereas RSV and PIV were detected mainly in children aged < 2 years, and Flu A affected all age groups.

The number of tests peaked in 2018 and decreased markedly in 2020. Although the testing increased in 2021, the 2021 total remained considerably below those of the three pre-pandemic years (Fig. 1A). The number of children who tested positive for respiratory viruses peaked in 2019 and decreased markedly in 2020, followed by a slight increase in 2021 (Fig. 1A). The detection rate of the five respiratory viruses for which children were tested, showed similar trends with a peak in 2019 followed by a decrease in 2020

and 2021 (Fig. 1B). RSV and PIV were the dominant respiratory viruses throughout the study period. Compared to 2017–2019, the relative prevalence of RSV and PIV increased in 2020 and 2021, whereas the relative prevalence of ADV, Flu A, and Flu B decreased (Fig. 1C). No Flu A was detected in 2021. From 2017 to 2019, the monthly number of positive test results and detection rates peaked in the winter and spring (Fig. 1D). In contrast, in 2020 and 2021, the monthly number of tests, number of positive tests, and detection rates sharply decreased. Following the lockdown from January 23 to April 8, 2020, the number of tests and the positivity rate remained very low for several months and did not increase until the start of the new school semester in September 2020. The number of tests and the positivity rate peaked again in the winter of 2020. In 2021, the number and prevalence of positive tests remained lower than those in 2017–2019, although the monthly peak in the number of tests was similar to that in 2017–2019 (Fig. 1D).

The regular seasonality in ADV, RSV, Flu A and Flu B detection from 2017 to 2019 was absent during the 2020–2021 season (Fig. 2A–D). Although the number of RSV infections increased toward the end of 2021 (Fig. 2B), the usual winter surge in influenza virus infections was minimal (Fig. 2C and D). From 2017 to 2019, seasonal peaks of PIV occurred during the summer (Fig. 2E). However, in 2020, the peak was delayed to November and an unseasonal increase in PIV infections also occurred toward the end of 2021. Before the COVID-19 pandemic, RSV was the dominant respiratory virus in hospitalized children during the autumn, winter, and spring, whereas ADV and PIV were the dominant respiratory viruses during the summer (Fig. 2F). In addition, concurrent peaks of RSV, Flu A, and Flu B occurred during the winters of 2017–2019 (Fig. 2G). However, in 2020 and 2021, there were no Flu A and very few Flu B infections, thus altering the synchronous pattern. Before the COVID-19 pandemic, the prevalence of RSV, ADV, and PIV tended to alternate (Fig. 2H). However, this pattern did not occur in 2020 and 2021.

Both the overall number of tests for respiratory virus infections and the number of positive tests, decreased substantially after the onset of the COVID-19 pandemic and implementation of NPI strategies in Wuhan. These results suggest that NPIs targeting COVID-19 prevent other respiratory virus infections, in addition to controlling the spread of SARS-CoV-2. Our results suggest that the application of NPIs may be less effective for the control of the RSV infections than other respiratory virus infections because RSV became the predominant pathogen among the five respiratory viruses after the introduction of NPIs. Additionally, infants and younger children are more susceptible than older children and adults to RSV and PIV infection.^{7,8}

This study has several limitations. First, it was a single-center study. Second, the respiratory virus test results were not confirmed by nucleic acid testing. Third, the usual flow and processes of seek-

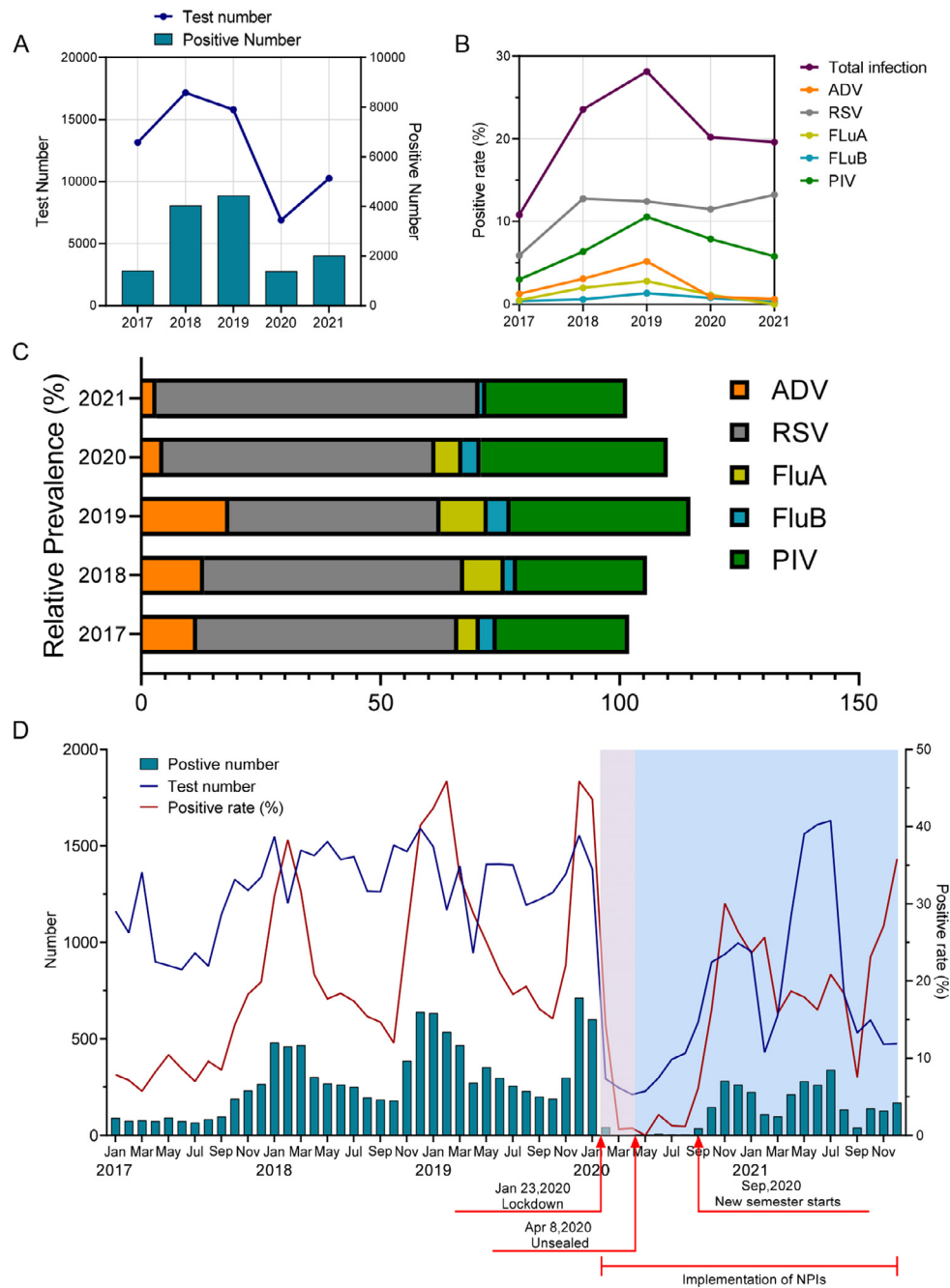


Fig. 1. Distribution and detection rates of five respiratory viruses in 63,270 hospitalized children, January 2017 to December 2020. Children were tested for ADV, RSV, Flu A, Flu B, and PIV on admission using a rapid antigen detection kit (Diagnostic Hybrids, Inc.). (A) Total number of tests and number of positive tests by year. (B) Overall positivity rate and positivity rates by virus type and year. (C) Relative prevalence of each respiratory virus by year. (D) Monthly distribution and detection rates of five respiratory viruses. The lockdown period from January 23 to April 8, 2020 is shown in gray, and the post-lockdown period is shown in blue. Abbreviations: ADV, adenovirus; Flu A, influenza A; Flu B, influenza B; NPIs, non-pharmaceutical interventions; PIV, parainfluenza virus; RSV, respiratory syncytial virus.

ing medical advice may have been interrupted during the lockdown period, which may have contributed to lower consultation and reporting rates, and reduced sample collection in inpatients. Nevertheless, our results highlight the positive impact of NPIs targeting COVID-19 on respiratory virus infections in young children in Wuhan, as in Hangzhou.

Ethics approval

The study was approved by the Medical Ethical Committee of the Maternal and Child Health Hospital of Hubei Province (2021-IEC-XM042), which waived the requirement for informed consent.

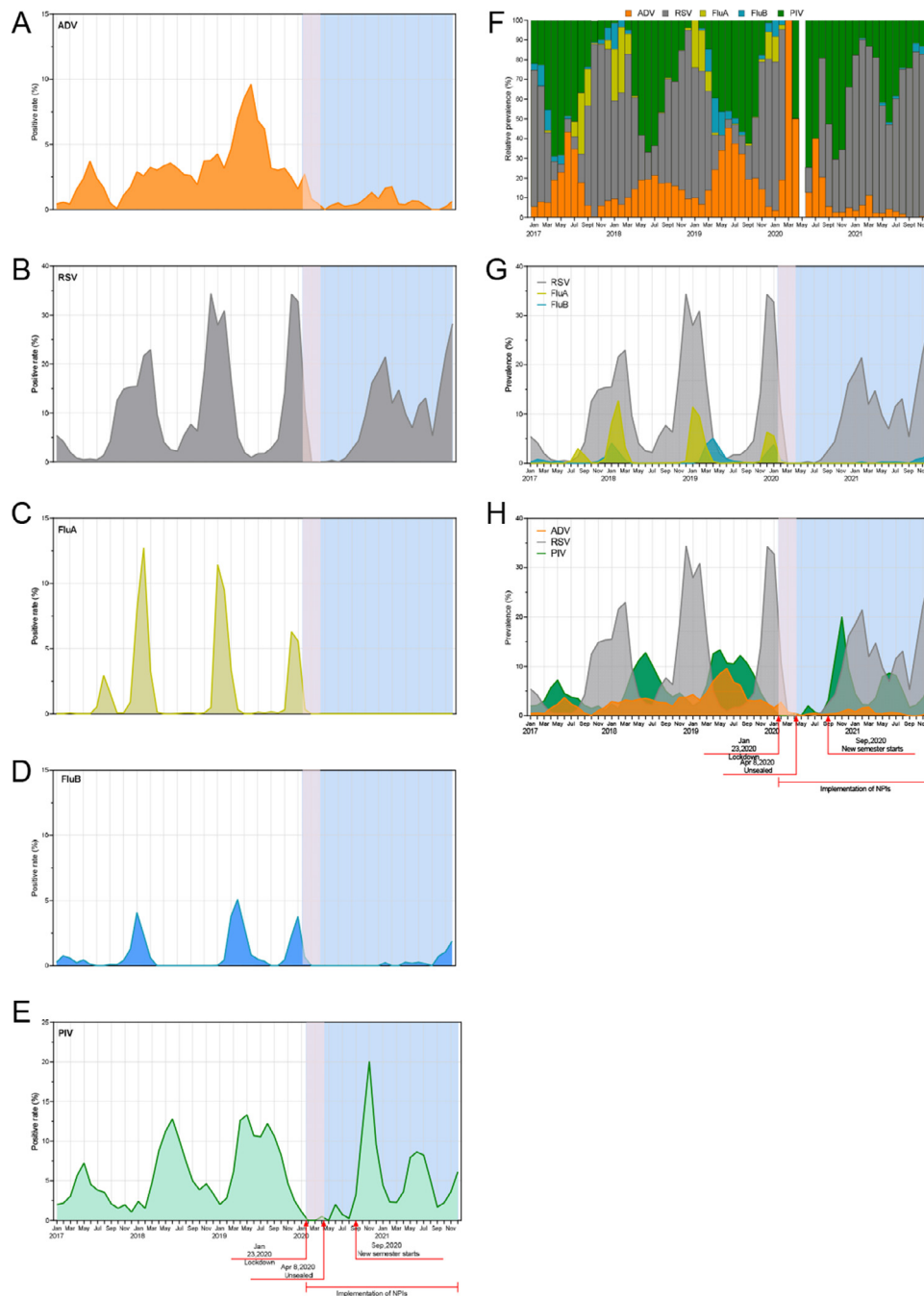


Fig. 2. Monthly distribution and detection rates of specific respiratory viruses in 63,270 hospitalized children, January 2017 to December 2020. (A) Monthly distribution and detection rates of ADV. (B) Monthly distribution and detection rates of RSV. (C) Monthly distribution and detection rates of Flu A. (D) Monthly distribution and detection rates of Flu B. (E) Monthly distribution and detection rates of PIV. (F) Monthly distribution showing the proportion of respiratory infections caused by each of the five respiratory viruses. (G) Monthly distribution of RSV, Flu A and Flu B. (H) Monthly distribution of ADV, RSV and PIV. The lockdown period from January 23 to April 8, 2020 is shown in gray, and the post-lockdown period is shown in blue. Abbreviations: ADV, adenovirus; Flu A, influenza A; Flu B, influenza B; NPIs, non-pharmaceutical interventions; PIV, parainfluenza virus; RSV, respiratory syncytial virus.

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Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:[10.1016/j.jinf.2022.08.044](https://doi.org/10.1016/j.jinf.2022.08.044).

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