

Background

Human coronaviruses (hCoVs) (other than SARS-CoV, SARS-CoV-2, MERS-CoV) cause respiratory infections globally, mainly mild infection in the upper respiratory tract [1]. However, respiratory virus co-infections occasionally cause synergistic effect in pathogenesis, resulting in enhanced disease severity and potentially contributing to higher morbidity and mortality [2-3]. There is limited knowledge about the epidemiology of human infections with hCoVs including the potential interactions with other co-circulating respiratory viruses.

Objectives

To characterize the epidemiology of hCoVs in Hong Kong during the COVID-19 pandemic using paediatric inpatient data from local hospitals.

Methods

Common respiratory viruses were tested using the multiplex RT-PCR on specimens collected from paediatric inpatients admitted in two public hospitals in Hong Kong between 1 January 2020 and 30 April 2023. The test could also simultaneously detect influenza A virus, influenza B virus, human metapneumovirus (HMPV), adenoviruses (AdVs), respiratory syncytial virus (RSV), human rhinoviruses/enterovirus, and parainfluenza virus (PIV) types 1-4. Infections with hCoVs and co-infections with other respiratory viruses (defined as ≥ 1 other virus than the hCoV detected from the same specimen) were analyzed for these patients. The frequency and proportion of detections with each respiratory virus was calculated by calendar month and year based on the date of admission. Comparisons of rates were made using the t-test.

Results

Detection of respiratory viruses in paediatric inpatients

The proportion of detection for each respiratory virus was calculated for 9888 clinical paediatric hospitalization samples from 9308 individual patients. Detections of the tested respiratory viruses declined sharply in early 2020 in Hong Kong (Figure 1). The majority of the hCoVs infections (2.5%) were attributed to the type OC43 (68.2%) although four types of hCoVs remained at a low level in 2021-2022.

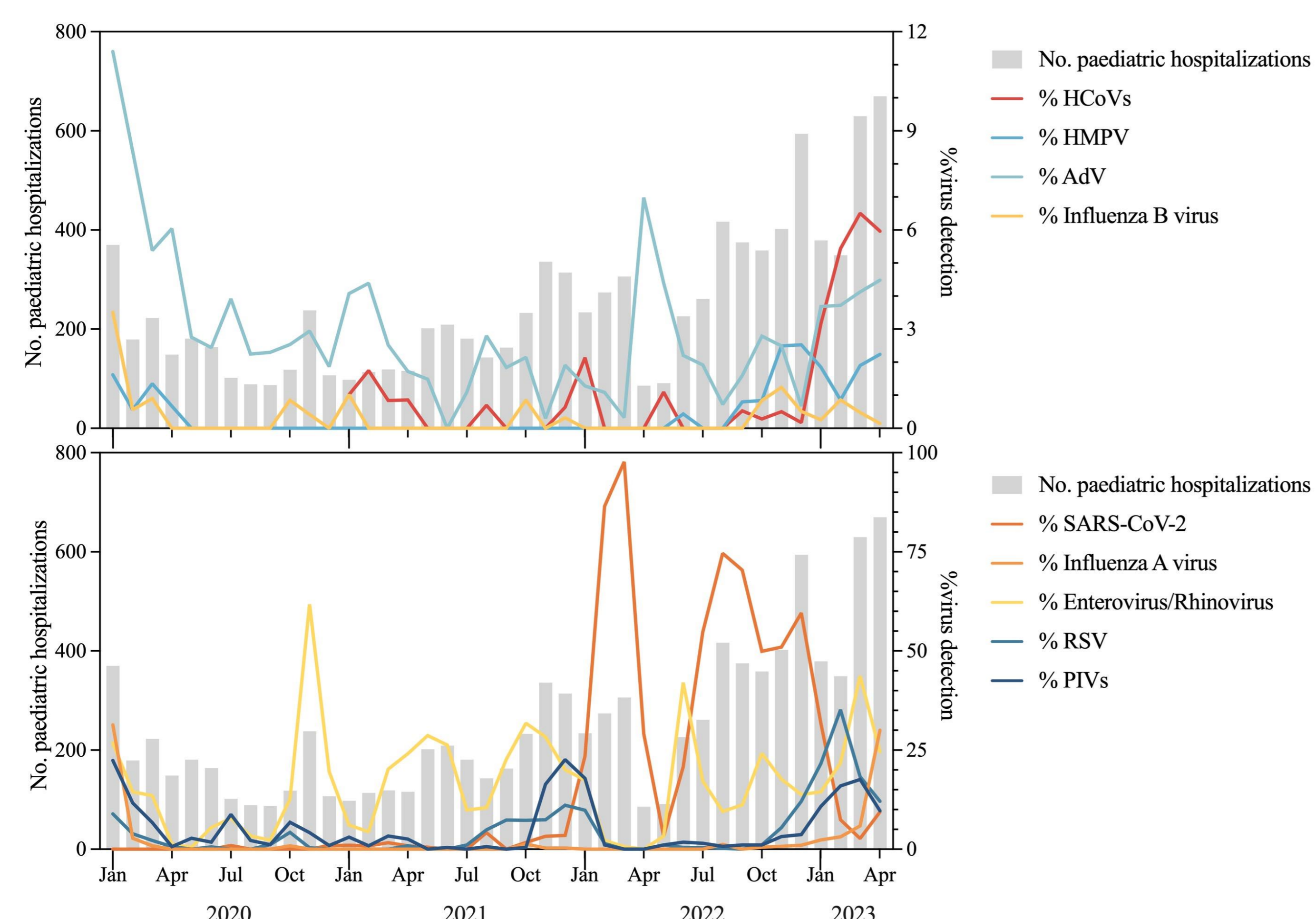


Figure 1. Paediatric hospitalizations and detection of respiratory viruses from hospitalized paediatric inpatients in two public hospitals in Hong Kong, 2020-2023.

Seasonality and age distribution of hCoV infections

Figure 2A showed the seasonal patterns of 4 types of hCoVs from January 2021 to April 2023. For all types of hCoVs proportion of paediatric hospitalization was at a low level. The increase of OC43 outcompeted other hCoVs peaking at 5.95% in April 2023.

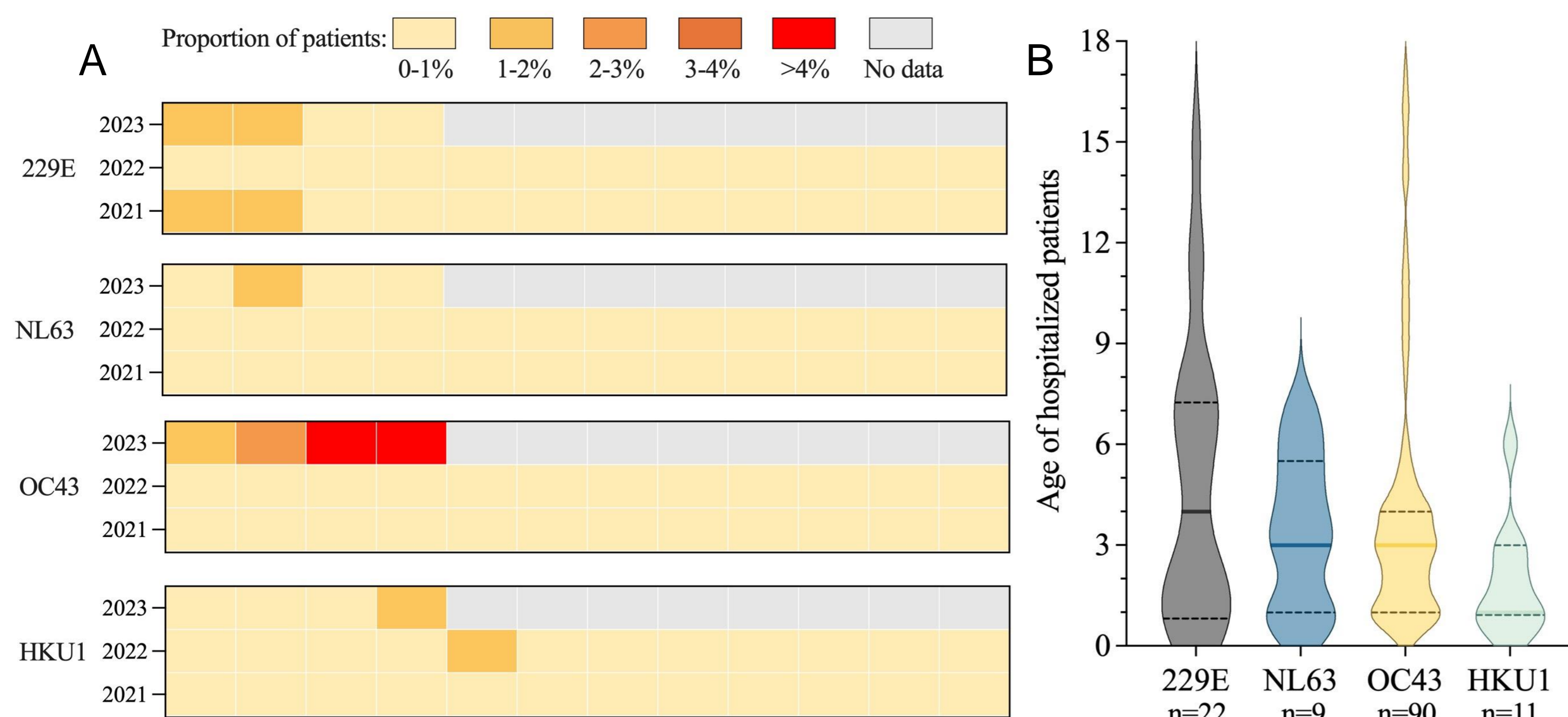


Figure 2. Monthly proportions of paediatric inpatients who were admitted into two public hospitals in Hong Kong testing positive for hCoVs during 2021-2023 (A). Age of paediatric inpatients who were admitted into two public hospitals in Hong Kong during 2021-2023 infected with hCoVs by virus type (B).

Figure 2B showed the age of paediatric inpatients who were admitted into two public hospitals in Hong Kong infected with hCoVs by virus type. Patients with different types of hCoVs have different age distributions. The median age of patients with 229E was 4, significantly higher than HKU1 infected ($P=0.034$). The median age of patients with NL63 was 3, as same as OC43 infected ($P=0.601$). The median age of patients with HKU1 was 1, lower than other hCoVs infected patients.

HCoVs co-infection with other respiratory viruses

Figure 3A showed the number of paediatric inpatients detected with hCoVs by virus type. Overall, there were 132 patients with hCoVs infected and 57 (43.2%) of patients represented co-infection with other respiratory viruses, while there were only 7.3% respiratory viruses-positive paediatric inpatients showed more than 1 virus detected. Nearly half of patients with OC43 (48.9%) and HKU1 (45.5%) presented co-infection with other respiratory viruses.

Figure 3B showed the number of hCoVs-positive paediatric inpatients and co-infected with other respiratory viruses by virus type. All types of hCoVs were detected in the co-infection with RSV. Most co-infection happened in patients with OC43, while Enterovirus/Rhinovirus was the most common ($n=20$), followed by PIV3 ($n=9$) and RSV ($n=9$). For the patients with HKU1, RSV was the most common ($n=3$).

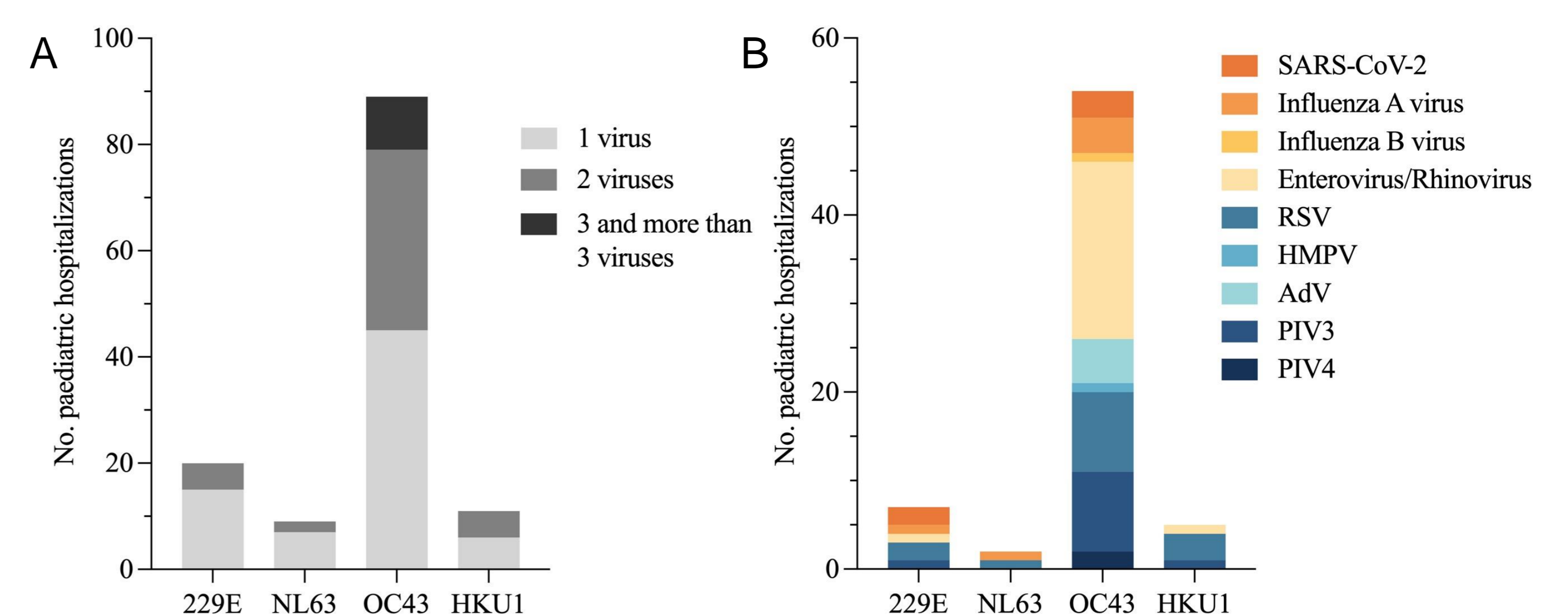


Figure 3. Numbers of paediatric inpatients detected with hCoVs by virus type, 2021-2023 (A). Numbers of paediatric inpatients testing positive for four types of hCoVs and co-infected with other respiratory viruses, 2021-2023 (B).

Conclusions

Circulation of hCoVs could be affected by public health and social measures applied during the COVID-19 pandemic. Varied detections of hCoVs after the pandemic warrant further studies on transmission dynamics between hCoVs or between different types of respiratory viruses.

References

- [1] Nickbakhsh S, Ho A, Marques D F P, et al. Epidemiology of Seasonal Coronaviruses: Establishing the Context for the Emergence of Coronavirus Disease 2019[J]. The Journal of Infectious Diseases, 2020, 222(1): 17-25.
- [2] Manna S, McAuley J, Jacobson J, et al. Synergism and Antagonism of Bacterial-Viral Coinfection in the Upper Respiratory Tract[J]. mSphere, 2022, 7(1): e0098421.
- [3] Aghbash P S, Eslami N, Shirvaliloo M, et al. Viral coinfections in COVID-19[J]. Journal of Medical Virology, 2021, 93(9): 5310-5322.