

## BRIEF REPORT

# Antibiotic prescriptions during the first 2 years of the COVID-19 pandemic in Finnish children

Social restrictions set due to the COVID-19 pandemic in March 2020 lead to rapid decrease in respiratory illnesses especially in children.<sup>1</sup> When the initial strict restrictions were loosened in Summer 2020, the paediatric emergency department visit rates seemed to return to normal in Finland.<sup>2</sup> Still the winter season 2020–2021 was exceptional, as respiratory syncytial virus (RSV) and influenza seasons did not appear at all in Finland. In fall 2021, as all restrictions were abandoned, circulation of respiratory pathogens returned and record-high levels of viral infections were registered in Finland.<sup>3</sup>

We described in our previous report that decreased paediatric infection rates led to decreased antibiotic consumption in Finland during 2020.<sup>4</sup> Similar findings were reported from the USA in 2020.<sup>5,6</sup> The reported decline in the antibiotic consumption has been almost 25% to 90% depending on the antibiotic assessed. However, we do not know what happened to antibiotic consumption after the social restrictions were ended and circulation of pathogens returned.

The aim of this study was to assess how antibiotic consumption has changed during the pandemic in paediatric population of Finland.

We conducted a nationwide register-based study on antibiotic prescriptions. All the outpatient antibiotic prescriptions were gathered from the Finnish Social Insurance Institution. All the pharmacies in Finland are mandated by the law to provide data on antibiotic prescriptions to the Social Insurance Institution. As all Finnish inhabitants have universal social insurance, all antibiotic prescriptions are registered despite where the prescription was provided (private sector, primary care, secondary care and tertiary care).

We included data from April 2019 to March 2020 as reference and compared yearly quarters between first pandemic year (April 2020 to March 2021) and second pandemic year (April 2021 to March 2022) to reference years. Compared to our previous report, our follow-up is now 15 months longer.<sup>4</sup> We included all the Finnish children aged 0–12 years old and stratified them into two age groups based on the default reporting of the register (0–5 and 6–12 years). We calculated prescription rates per 1000 children and comparisons were made by rate ratios with 95% confidence intervals. We stratified the antibiotics based on the ATC classification and we included only per oral systematic antibiotics (ATC class J01\*). We included only beta-lactamases (including cephalosporines) and macrolide group antibiotics, as these cover over 95% of the prescriptions.

We did not need research permission or ethical committee evaluation as our study used routinely collected open-access data.

We included a total of 314,943 antibiotic prescriptions from April 2019 to March 2022. Of these, 90.3% were beta-lactamases. Majority of the prescriptions (68.8%) were given to children aged 0–5 years.

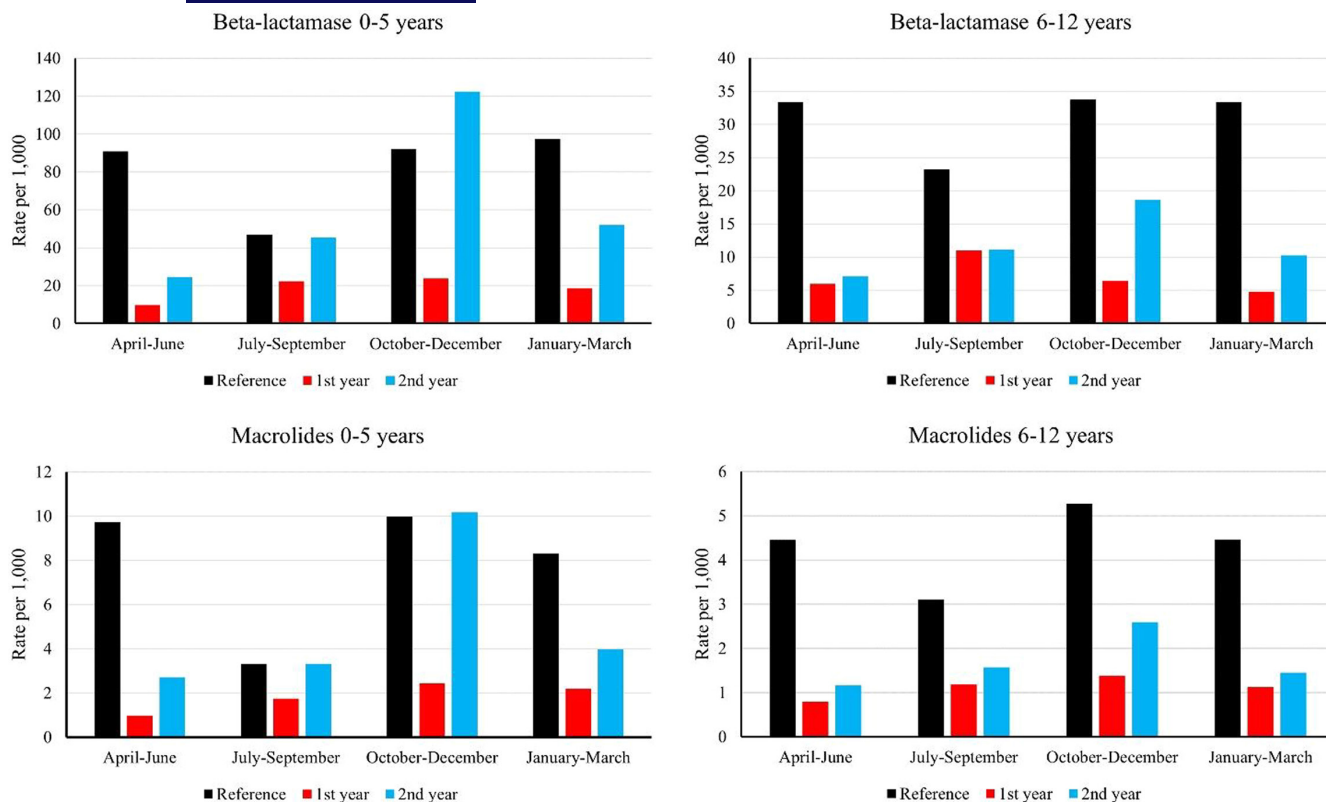
Antibiotic consumption decreased rapidly in both beta-lactamase and macrolides among children aged 0–5 years during the first year of the pandemic (Figure 1) and remained in lower level until fall 2021. The decrease was 90% during the first 3 months of the pandemic (Table S1). The consumption returned to normal level in July 2021 and beta-lactamase consumption was 33% higher during the last 3 months of 2021 than in the reference year. Prescription rates of both antibiotics in this age group decreased again in the beginning of 2022. The decrease was 47% in beta-lactamase and 52% in macrolides (Table S1).

Antibiotic prescriptions decreased by 82% in the first 3 months of the pandemic in children aged 6–12 years (Table S1). The prescription rates of both beta-lactamase and macrolides have remained lower throughout the pandemic in this age group (Figure 1).

We found that antibiotic prescription rates remained at low level during the first year of the pandemic and turned to a clear increase in young children during early fall 2021 when social restrictions were ended in Finland. The changes in the prescription rates were larger during the follow-up in younger children. The arrival of the SARS-CoV-2 omicron variant in December 2021 and the return of social restrictions in January 2022 lead to a decrease in antibiotic prescriptions again during early 2022.

Our report is in line with the previous publication with the reduction of antibiotic prescriptions during the first year of the pandemic.<sup>4–6</sup> One previous study from the United States found that antibiotic prescriptions turned to increase in late spring 2021.<sup>6</sup> The decrease in antibiotic consumption has been mostly due to respiratory infections.

Acute otitis media and pneumonia are among the most typical indications for antibiotics in the youngest children. Acute otitis media is typically a complication for viral respiratory tract infection and pneumonia cases are treated with antibiotic regardless of the microbiological aetiology. Therefore, it was not surprising that antibiotic



**FIGURE 1** Quarterly antibiotic prescription rates per 1000 children stratified by age (0–5 and 6–12 years) from April 2019 to March 2022. Reference period was from April 2019 to March 2020. The 1st pandemic years was from April 2020 to March 2021 and the 2nd pandemic year from April 2021 to March 2022.


prescription trends followed respiratory virus circulation trends. The ending of social restrictions in summer 2021 lead to a record high-parainfluenza epidemic and to an unusual high and early RSV epidemic peak in fall 2021.<sup>3</sup> As the youngest children are more prone to the bacterial complications of viral diseases, it was unsurprising that the antibiotic prescription rebound was clearer in the youngest children than in the older age group.

Our main strength is the nationwide register and the Finnish universal social insurance system which means that we have information from the whole paediatric population of nearly one million and all the social classes and ethnicities. Our main limitation is the lack of diagnoses, as these are not reported to the same nationwide register. The data on diagnoses in 2022 will be available in September 2023. Further limitation is the lack of dosing, which is not reported to the register. This would have enabled us to count more precise estimation of the changes in the antibiotic consumption.

In conclusion, we report that the ending of social restriction in summer 2021 lead to rapid increase in antibiotic prescriptions among children aged 0–5 years. However, the rapid increase turned to rapid decline as social restrictions were implemented back in use in January 2022 due the omicron variant of SARS-CoV-2. The changes among the older children were not as prominent and their prescription rate has remained below reference throughout the pandemic. Continuous monitoring of antibiotic consumption is important to estimate prescription trends.

**CONFLICT OF INTEREST**

None of the authors have any potential conflicts of interest to declare.

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**REFERENCES**

1. Yeoh DK, Foley DA, Minney-Smith CA, et al. Impact of coronavirus disease 2019 public health measures on detections of influenza and

- respiratory syncytial virus in children during the 2020 Australian winter. *Clin Infect Dis*. 2021;72(12):2199-2202. doi:10.1093/cid/ciaa1475
2. Kuitunen I, Haapanen M, Artama M, Renko M. Closing Finnish schools and day care centres had a greater impact on primary care than secondary care emergency department visits. *Acta Paediatr*. 2021;110(3):937-938. doi:10.1111/apa.15646
  3. Kuitunen I, Artama M, Haapanen M, Renko M. Respiratory virus circulation in children after relaxation of COVID-19 restrictions in fall 2021—a nationwide register study in Finland. *J Med Virol*. 2022;94(9):4528-4532. doi:10.1002/jmv.27857
  4. Haapanen M, Renko M, Artama M, Kuitunen I. Systemic antibiotics and asthma medicines dispensed to 0-12 year olds significantly decreased during the COVID-19 pandemic in 2020. *Acta Paediatr*. 2022;111(2):376-382. doi:10.1111/apa.16144
  5. Chua KP, Volerman A, Conti RM. Prescription drug dispensing to US children during the COVID-19 pandemic. *Pediatrics*. 2021;148(2):e2021049972. doi:10.1542/peds.2021-049972
  6. Dutcher L, Li Y, Lee G, Grundmeier R, Hamilton KW, Gerber JS. COVID-19 and antibiotic prescribing in pediatric primary care. *Pediatrics*. 2022;149(2):e2021053079. doi:10.1542/peds.2021-053079

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