

COVID-19 in Children and the Dynamics of Infection in Families

Klara M. Posfay-Barbe, MD,^a Noemie Wagner, MD,^a Magali Gauthey, MD,^b Dehlia Moussaoui, MD,^c Natasha Loevy, MD,^d Alessandro Diana, MD,^{e,f} Arnaud G. L'Huillier, MD^{a,g}

Since the onset of coronavirus disease (COVID-19) pandemic, children have been less affected than adults in terms of severity^{1–3} and frequency, accounting for <2% of the cases.^{2–5} Unlike with other viral respiratory infections, children do not seem to be a major vector of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) transmission, with most pediatric cases described inside familial clusters⁶ and no documentation of child-to-child or child-to-adult transmission.^{7,8} The aim of this work was to describe the clinical presentation of the first 40 pediatric cases of COVID-19 in our city and the dynamics of their familial clusters.

METHODS

From March 10 to April 10, 2020, all patients <16 years old with SARS-CoV-2 infection were identified by means of the Geneva University Hospital's surveillance network (Switzerland). The network notifies the institution's pediatric infectious diseases specialists about results of nasopharyngeal specimens tested for SARS-CoV-2 by reverse-transcription polymerase chain reaction. This study was approved by the Regional Ethics Committee. After informed oral parental consent and its documentation in the medical charts, chart reviews were used to retrieve clinical data, and parents were called for patients and household contacts (HHCs) follow-up. HHCs were considered suspect if they had fever or acute respiratory symptoms, as per the

Swiss Federal Office for Public Health's case definition⁹ (Supplemental Information).

Categorical data were compared using the χ^2 test, with *P* values <.05 considered significant. Statistics were performed using SPSS version 23.0 (IBM SPSS Statistics, IBM Corporation).

RESULTS

Among a total of 4310 patients with SARS-CoV-2, 40 were <16 years old (0.9%). One patient for which telephone follow-up was not possible was excluded because of the inability to evaluate clinical evolution and HHC symptoms. The median follow-up of the households was 18 days (interquartile range [IQR]: 14–28).

Clinical Presentation, Diagnosis, and Management

Demographics, clinical presentation, and diagnosis of the study children are detailed in Table 1. Of note, 29 (74%) patients were previously healthy; the most frequently reported comorbidities were asthma (10%), diabetes (8%), obesity (5%), premature birth (5%), and hypertension (3%). Seven patients (18%) were hospitalized to the ward, for a median duration of 3 days (IQR: 2–4); reasons for admission were surveillance for nonhypoxemic viral pneumonia (*n* = 2), fever without source (*n* = 2), apparent life-threatening event (*n* = 1), and sepsis-like event (*n* = 1); 1 paucisymptomatic child admitted



^aPediatric Infectious Diseases Unit, ^cDivision of General Pediatrics, and ^dPediatric Platform for Clinical Research, Geneva University Hospitals and Faculty of Medicine, University of Geneva, Geneva, Switzerland; ^bPediatric Department, Hôpital de La Tour, Geneva, Switzerland; ^ePrimary Care Unit, University of Geneva, Geneva, Switzerland; ^fClinique des Grangettes, Geneva, Switzerland; and ^gDivision of Infectious Diseases and Laboratory of Virology, Division of Laboratory Medicine, Geneva University Hospitals and Medical School, Geneva, Switzerland

Drs Posfay-Barbe, Wagner, and L'Huillier conceived and designed the study, designed the data collection instruments, conducted the initial analyses, drafted the initial manuscript, and reviewed and revised the manuscript. Drs Gauthey, Moussaoui, Loevy, and Diana critically reviewed the manuscript for important intellectual content and reviewed and revised the manuscript; and all the authors coordinated and supervised data collection and approved the final manuscript as submitted and agree to be accountable for all aspects of the work.

DOI: <https://doi.org/10.1542/peds.2020-1576>

Accepted for publication May 12, 2020

Address correspondence to Arnaud G. L'Huillier, MD, Pediatric Infectious Diseases Unit, Department of Woman, Child and Adolescent Medicine, Geneva University Hospitals and Medical School, 6 rue Willy-Donze, 1211 Geneva 14, Switzerland.

E-mail: arnaud.lhuillier@hcuge.ch

PEDIATRICS (ISSN Numbers: Print, 0031-4005; Online, 1098-4275).

Copyright © 2020 by the American Academy of Pediatrics

FINANCIAL DISCLOSURE: The authors have indicated they have no financial relationships relevant to this article to disclose.

FUNDING: No external funding.

POTENTIAL CONFLICT OF INTEREST: The authors have indicated they have no potential conflicts of interest to disclose.

To cite: Posfay-Barbe KM, Wagner N, Gauthey M, et al. COVID-19 in Children and the Dynamics of Infection in Families. *Pediatrics*. 2020;146(2):e20201576

In 79% of households, ≥ 1 adult family member was suspected or confirmed for COVID-19 before symptom onset in the study child, confirming that children are infected mainly inside familial clusters.⁶ Surprisingly, in 33% of households, symptomatic HHCs tested negative despite belonging to a familial cluster with confirmed SARS-CoV-2 cases, suggesting an underreporting of cases. In only 8% of households did a child develop symptoms before any other HHC, which is in line with previous data in which it is shown that children are index cases in $< 10\%$ of SARS-CoV-2 familial clusters¹⁰; however, with our study design, we cannot confirm that child-to-adult transmission occurred.

This study has some limitations. The study sample likely does not represent the total number of pediatric SARS-CoV-2 cases during this time period. Indeed, patients with milder or atypical presentation might not have sought medical attention. Moreover, the recall of symptom onset among HHCs might be inaccurate, although this seems for once less likely because of the confinement measures and anxiety in the community.

The results of this study are important because of the extensive

HHC tracing and the almost absence of loss to follow-up. Extended diagnostic screening of suspected cases and thorough contact tracing are needed to better understand the dynamics of transmission within households.

ABBREVIATIONS

COVID-19: coronavirus disease
HHC: household contact
IQR: interquartile range
SARS-CoV-2: severe acute respiratory syndrome coronavirus 2

REFERENCES

1. Dong Y, Mo X, Hu Y, et al. Epidemiology of COVID-19 among children in China. *Pediatrics*. 2020;145(6):e20200702
2. CDC COVID-19 Response Team. Coronavirus disease 2019 in children - United States, February 12–April 2, 2020. *MMWR Morb Mortal Wkly Rep*. 2020;69(14):422–426
3. Livingston E, Bucher K. Coronavirus Disease 2019 (COVID-19) in Italy. *JAMA*. 2020;323(4):1335
4. Tagarro A, Epalza C, Santos M, et al. Screening and severity of coronavirus disease 2019 (COVID-19) in children in Madrid, Spain [published online ahead

of print April 8, 2020]. *JAMA Pediatr*:doi:10.1001/jamapediatrics.2020.1346

5. Wu Z, McGoogan JM. Characteristics of and important lessons from the Coronavirus Disease 2019 (COVID-19) outbreak in China: summary of a report of 72 314 cases from the Chinese center for disease control and prevention. *JAMA*. 2020;323(13):1239–1242
6. Lu X, Zhang L, Du H, et al; Chinese Pediatric Novel Coronavirus Study Team. SARS-CoV-2 infection in children. *N Engl J Med*. 2020;382(17):1663–1665
7. World Health Organization. *Report of the WHO-China Joint Mission on Coronavirus Disease 2019 (COVID-19)*. Geneva: World Health Organization; 2020
8. Danis K, Epaulard O, Bénét T, et al; Investigation Team. Cluster of coronavirus disease 2019 (Covid-19) in the French Alps, 2020 [published online ahead of print April 11, 2020]. *Clin Infect Dis*. 2020. doi:10.1093/cid/ciaa424
9. Federal Office of Public Health. Available at: <https://www.bag.admin.ch/bag/en/home.html>. Accessed April 22, 2020
10. Zhu Y, Bloxham CJ, Hulme KD, et al. Children are unlikely to have been the primary source of household SARS-CoV-2 infections. Available at: <https://www.medrxiv.org/content/10.1101/2020.03.26.20044826v1>. Accessed June 15, 2020

COVID-19 in Children and the Dynamics of Infection in Families

Klara M. Posfay-Barbe, Noemie Wagner, Magali Gauthey, Dehlia Moussaoui,
Natasha Loevy, Alessandro Diana and Arnaud G. L'Huillier

Pediatrics originally published online May 26, 2020; originally published online May 26, 2020;

Updated Information & Services

including high resolution figures, can be found at:
<http://pediatrics.aappublications.org/content/early/2020/07/08/peds.2020-1576>

References

This article cites 6 articles, 1 of which you can access for free at:
<http://pediatrics.aappublications.org/content/early/2020/07/08/peds.2020-1576#BIBL>

Subspecialty Collections

This article, along with others on similar topics, appears in the following collection(s):
Infectious Disease
http://www.aappublications.org/cgi/collection/infectious_diseases_sub
Epidemiology
http://www.aappublications.org/cgi/collection/epidemiology_sub

Permissions & Licensing

Information about reproducing this article in parts (figures, tables) or in its entirety can be found online at:
<http://www.aappublications.org/site/misc/Permissions.xhtml>

Reprints

Information about ordering reprints can be found online:
<http://www.aappublications.org/site/misc/reprints.xhtml>

American Academy of Pediatrics

DEDICATED TO THE HEALTH OF ALL CHILDREN®



PEDIATRICS®

OFFICIAL JOURNAL OF THE AMERICAN ACADEMY OF PEDIATRICS

COVID-19 in Children and the Dynamics of Infection in Families

Klara M. Posfay-Barbe, Noemie Wagner, Magali Gauthey, Dehlia Moussaoui,
Natasha Loevy, Alessandro Diana and Arnaud G. L'Huillier

Pediatrics originally published online May 26, 2020; originally published online May
26, 2020;

The online version of this article, along with updated information and services, is
located on the World Wide Web at:

<http://pediatrics.aappublications.org/content/early/2020/07/08/peds.2020-1576>

Data Supplement at:

<http://pediatrics.aappublications.org/content/suppl/2020/07/09/peds.2020-1576.DCSupplemental>

Pediatrics is the official journal of the American Academy of Pediatrics. A monthly publication, it has been published continuously since 1948. Pediatrics is owned, published, and trademarked by the American Academy of Pediatrics, 345 Park Avenue, Itasca, Illinois, 60143. Copyright © 2020 by the American Academy of Pediatrics. All rights reserved. Print ISSN: 1073-0397.

American Academy of Pediatrics

DEDICATED TO THE HEALTH OF ALL CHILDREN®

