

## Changes in RT-PCR-positive SARS-CoV-2 rates in adults and children according to the epidemic stages

Corinne Levy,<sup>1,2,3,4</sup> Romain Basmaci,<sup>2,5</sup> Philippe Bensaïd,<sup>6</sup> Cécile Bost Bru,<sup>2,7</sup> Edeline Coïnde,<sup>8</sup> Emmanuelle Dessieux,<sup>9</sup> Cécile Fournial,<sup>10</sup> Jean Gashignard,<sup>2,11</sup> Hervé Haas,<sup>2,12</sup> Véronique Hentgen,<sup>2,13</sup> Frédéric Huet,<sup>14</sup> Muriel Lalande,<sup>15</sup> Alain Martinot,<sup>2,16</sup> Charlotte Pons,<sup>17</sup> Anne Sophie Romain,<sup>2,18</sup> Nicoleta Ursulescu,<sup>19</sup> François Vie Le Sage,<sup>2,20,21</sup> Josette Raymond,<sup>2,22</sup> Stéphane Béchet,<sup>1</sup> Julie Toubiana,<sup>2,23</sup> Robert Cohen,<sup>1,2,3,4</sup>

<sup>1</sup>ACTIV, Association Clinique et Thérapeutique Infantile du Val-de-Marne, Créteil, France

<sup>2</sup>GPIP, Groupe de Pathologie Infectieuse Pédiatrique, Paris, France

<sup>3</sup>Université Paris Est, IMRB-GRC GEMINI, Créteil, France

<sup>4</sup>Clinical Research Center (CRC), Centre Hospitalier Intercommunal de Créteil, Créteil, France

<sup>5</sup>Service de Pédiatrie, Hôpital Louis Mourier, Colombe, France

<sup>6</sup>Service de Pédiatrie, Centre Hospitalier Victor Dupouy, Argenteuil, France

<sup>7</sup>Service de Pédiatrie, CHU Grenoble, France

<sup>8</sup>CHU Ajaccio, Ajaccio, France

<sup>9</sup>Service de Pédiatrie, Hôpitaux du Pays du mont-Blanc, France

<sup>10</sup>Laboratoire de biologie, CHU Nantes, Nantes, France

<sup>11</sup>Service de Pédiatrie, Hôpital Robert Debré, France

<sup>12</sup>Service de Pédiatrie, CHU de Nice, Nice, France

<sup>13</sup>Service de Pédiatrie, Hôpital A Mignot, Centre Hospitalier de Versailles, France

<sup>14</sup>Service de Pédiatrie 1 et de Génétique Médicale, Hôpital d'Enfants, Dijon, France

<sup>15</sup>Service de Pédiatrie, CHU Montpellier, Montpellier, France

<sup>16</sup>Service de Pédiatrie, CHU Lille, Lille France

<sup>17</sup>Service de Pédiatrie CHU Avignon, Avignon, France

<sup>18</sup>Service de Pédiatrie Hôpital Trousseau, Paris, France

<sup>19</sup>Service de Pédiatrie et de néonatalogie, Hôpital Nord Franche-Comté, Belfort, France

<sup>20</sup>Service de Pédiatrie, Hôpital de Chambéry, France

<sup>21</sup>AFPA, Association Française de Pédiatrie Ambulatoire, France

<sup>22</sup>Service de Microbiologie, CHU Kremlin Bicêtre, Kremlin Bicêtre, France

<sup>22</sup>Service de Pédiatrie Hôpital Necker, Paris, France

**Keywords:** RT-PCR SARS-Cov2, children, adults

**Corresponding author:**

Dr Corinne Levy, ACTIV

31, rue Le Corbusier, 94000 Créteil, France.

Email address: [corinne.levy@activ-france.fr](mailto:corinne.levy@activ-france.fr)

Phone: 0033148850404

**Abstract**

**Aim** To describe the trends of RT-PCR positive SARS-CoV-2 rates in children and adults according to the time of COVID-19 epidemic.

**Methods** In this prospective multicenter study involving 45 pediatric units, we collected the results of nasopharyngeal swabs in France from March 2, 2020 to April 26, 2020.

**Results** During the study period, 52,588 RT-PCR tests for SARS-CoV-2 were performed, 6,490 in children and 46,098 in adults. The rate of positive tests for children was 2- to 7-fold less than that for adults. These rates varied according to the time of the epidemic and were higher at the peak. The lower rates of positive test in children persisted during the surveillance period but varied according to the time in the epidemic.

**Conclusion** The rate of positive RT-PCR positive SARS-CoV-2 tests for children was always less than that for adults but vary according to the epidemic stage.

**What is already known on this topic?**

- The number of confirmed pediatric SARS-CoV-2 infection is relatively low.
- The rate of RT-PCR-positive SARS-CoV-2 was significantly lower for children than adults.

**What this study adds?**

- The SARS-CoV-2–positive rate for children was about 2- to 7-fold less than that for adults during the surveillance period.
- The difference in rates between children and adults persisted during the surveillance period but varied according to the time in the epidemic, the rate of positivity and the region.

## Introduction

France is one of the main countries affected by COVID-19, with more than 83,000 hospitalized cases at the epidemic peak.<sup>1</sup> The morbi-mortality of this virus is highly variable among age groups.<sup>2, 3</sup> In France and in other countries, the number of confirmed pediatric cases is relatively low, and they account for less than 1% of hospitalized cases and deaths.<sup>3-6</sup> In France, the strategy of closing schools and the lockdown started on March 17, 2020, but little information is available about the transmission between children and adults.<sup>5, 7</sup> We aimed to describe the trends of RT-PCR–positive SARS-CoV-2 rates in children and adults as compared with the profile of the national epidemic curve of new COVID-19 in France.<sup>1</sup>

## Methods

With the Association Clinique et Thérapeutique Infantile du Val de Marne (ACTIV) and Groupe de Pathologie Infectieuse Pédiatrique (GPIP) network research units, we conducted a prospective multicenter study involving 45 pediatric wards and emergency units in France from March 2, 2020 to April 26, 2020. Depending on hospital guidelines, results of nasopharyngeal swabs were collected from patients visiting emergency departments or who were hospitalized. RT-PCR analysis for SARS-CoV-2 was performed in the virology laboratory of each hospital. Two times a week, each clinical investigator from each participating ward was contacted to obtain information on SARS-CoV-2–positive tests. Stata SE v13.1 (Statacorp, College Station, TX) was used for analysis and 95% confidence intervals (95% CIs) were calculated.

## Results

During the study period, 52,588 RT-PCR tests for SARS-CoV-2 were performed, 6,490 in children (12.3%) and 46,098 in adults (87.7%). The cumulative rate of positive tests for children was 5.9%, 95% CI [5.3; 6.5], (n=382), 3.5-fold less than that for adults (20.3%, 95% CI [19.9;20.6], (n=9,346).

The figure 1 shows the trends of positive testing in children and adults in France and in the Paris area, one of the most affected regions, as well as the overall national trend in new Covid-19 cases.

In France, from the beginning of the epidemic until March 15, only 3.1% (95% CI [2.4; 4.1], n=53) of 1,690 pediatric samples were positive, 4.5-fold less than for adults (13.8%, 95% CI [13.1;14.6], n=1,124 of 8,155 adult samples). At the peak of the national outbreak, on March

30, 9.7% (95% CI [7.9; 11.8], n=85) of 877 pediatric samples were positive, 2.8-fold lower than for adults, 27.2%, 95% CI [26.2; 28.2], n=2054 of 7,557 adult samples). A rapid decrease was observed during the following weeks, with the lowest rate reported the week of April 20, 3.4% (95% CI [2.5; 4.8], n=33) of 960 pediatric samples were positive, 2.2-fold lower than for adults, 7.6%, 95% CI [7.0; 8.2], n=514 of 6,791 adult samples).

In Paris area, the same trends were observed with marked differences between adults and children.

The figure 2 shows the evolution of the ratio of RT-PCR–positive SARS-CoV-2 tests between adults and children in France and in the Paris area during the study period according to new COVID-19 cases reported by the National Health Institute

For Paris area, at the start of the epidemic, the positivity rate was 7-fold higher in adults than children, whereas at the peak and at the end of the epidemic, it was only 3-fold higher.

## Discussion

Our results showed that the SARS-CoV-2–positive rate for children was about 2- to 7-fold less than that for adults during the surveillance period. However, the dynamics of the curve for children followed that for adults and the National curve for new COVID-19.<sup>1</sup> The difference in rates between children and adults persisted during the surveillance period but varied according to the time in the epidemic, the rate of positivity and the region. In the Paris area, the most affected region, we observed a high spread of the disease in children, reaching more than 14.3% positive tests at the epidemic peak. At the start of the epidemic, the positivity rate was 7-fold higher in adults than children, whereas at the peak, it was only 3-fold higher.

As expected, the major impact of the lockdown was observed about 15 days after it began, with a rapid decrease in SARS-CoV-2–positive rate. Of note, the more the rate in adults increased, the less the difference between the two populations (adults and children), which supports that the main way of transmission was from adults to children.<sup>4, 5, 7</sup> Indeed, in this study, as in many others, the rate of RT-PCR–positive SARS-CoV-2 was significantly lower for children than adults.<sup>4, 8</sup> **Even if the viral load is comparable for children and adults, this fact added to the low rates of secondary cases at schools argue simultaneously for at least a modest role of children in the dynamic of the COVID-19 pandemic and the re-opening schools.**<sup>5, 7, 9, 10</sup>

The slight increase of the ratio between children and adults at the end of the epidemic is possibly explained by the occurrence of Kawasaki like syndromes or hyperinflammatory shock in children 2 to 4 weeks after the peak epidemic<sup>11,12</sup>.

Our study has several limitations. **Our rates of RT-PCR–positive SARS-CoV-2 must take into account that RT-PCR practices were heterogeneous and could have evolved depending on the guidelines and the availability of the tests for adults and children.** Even if we cannot rule out that some cases could have escaped our surveillance in our centers and that we did not survey the whole country, our results are consistent with the dynamic of the COVID-19 pandemic in France.<sup>1</sup> Finally, the viral load was not available in our study for children and adults.

We think that the surveillance of RT-PCR–positive tests in adults and children could be a simple and reliable tool to survey the epidemiology of SARS-CoV-2 infection, allowing to quickly detect any re-emergence of the disease.

## References

1. Jarlier V. <https://infogram.com/graphiques-covid-1h8n6mymkewj6xo?live>. 2020.
2. Dong Y, Mo X, Hu Y, *et al*. Epidemiology of COVID-19 Among Children in China. *Pediatrics*. 2020.
3. Guan WJ, Ni ZY, Hu Y, *et al*. Clinical Characteristics of Coronavirus Disease 2019 in China. *N Engl J Med*. 2020.
4. Gudbjartsson DF, Helgason A, Jonsson H, *et al*. Spread of SARS-CoV-2 in the Icelandic Population. *N Engl J Med*. 2020.
5. National Centre for Immunisation and Surveillance. COVID-19 in schools- the experience in NSW. <http://www.ncirs.org.au/covid-19-in-schools> [Accessed 7 May 2020]. 2020.
6. Parri N, Lenge M, Buonsenso D, *et al*. Children with Covid-19 in Pediatric Emergency Departments in Italy. *N Engl J Med*. 2020.
7. Danis K, Epaulard O, Benet T, *et al*. Cluster of coronavirus disease 2019 (Covid-19) in the French Alps, 2020. *Clin Infect Dis*. 2020.
8. Jones TC, Mühlemann B, Veith T, *et al*. An analysis of SARS-CoV-2 viral load by patient age. [https://zoonosencharitede/fileadmin/user\\_upload/microsites/m\\_cc05/virologie-ccm/dateien\\_upload/Weitere\\_Dateien/analysis-of-SARS-CoV-2-viral-load-by-patient-age.pdf](https://zoonosencharitede/fileadmin/user_upload/microsites/m_cc05/virologie-ccm/dateien_upload/Weitere_Dateien/analysis-of-SARS-CoV-2-viral-load-by-patient-age.pdf). 2020.
9. The National Institute for Public Health and the Environment (RIVM). Children and COVID-19. <https://www.rivm.nl/en/novel-coronavirus-covid-19/children-and-covid-19> [accessed 7 May 2020]. 2020.
10. Munro APS, Faust SN. Children are not COVID-19 super spreaders: time to go back to school. *Archives Disease Childhood*. 2020; **In Press**.
11. Ouldali N, Pouletty M, Mariani P, *et al*. Emergence of Kawasaki disease related to SARS-CoV-2 infection in children, a time-series analysis. *Jama Pediatrics* Submitted. 2020.
12. Riphagen S, Gomez X, Gonzalez-Martinez C, *et al*. Hyperinflammatory shock in children during COVID-19 pandemic. *Lancet*. 2020.

## **Acknowledgments**

We thank all pediatricians and microbiologists who participated in the study:

Belgaid A, Belivier E, Bueno B, Brehin C, Caurier B, Chevret L, Claris O, Cohen L, De Pontual L, Dolfi-Fiette H, Dutron S, Faye A, Flatres C, Gajdos V, Garraffo A, Hau I, Jarlier V, Labarthe F, Laisney N, Le Stradic C, Loeile C, Mandelcwajg A, Marques C, Minodier P, Ouldali N, Pantalone L, Peigne C, Pierre MH, Pinquier D, Rey A, Teissier R, Thach C, Vignaud O.

## **Contributors**

CL, RC and VH conceived and designed the study. CL and RC were involved in writing, reviewing and coordinating the submission of the manuscript. RB, ASR, JT, PB, CBB, EC, ED, CF, JG, HH, FH, ML, AM, CP, NU, FLS, JR contributed to data collection from their respective paediatric centres and have reviewed the manuscript. SB have reviewed the manuscript.

**Funding** : No funding

**Conflict of interest statement:** None declared

**Patient consent for publication:** Not required

**Ethics approval:** The GFHGNP (Groupe Francophone d'Hépatologie et Nutrition Pédiatrique) Ethics Committee, certifies that this study "Surveillance of SARS CoV2 positive PCR in France" performed by the GPIP ACTIV doesn't required any ethical approval due to the absence of personal data.

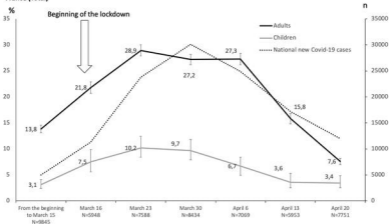


## Figures Legend

**Figure 1.** Evolution of RT-PCR–positive SARS-CoV-2 rates in France and in Paris area in children and adults as compared with new COVID-19 cases reported by the National Health Institute [1].

**Figure 2.** Evolution of the ratio of RT-PCR–positive SARS-CoV-2 tests between adults and children in France and in the Paris area during the study period according to new COVID-19 cases reported by the National Health Institute [1].

### France (Total)



### Paris area

