


# COVID-19 Restrictions Are Associated With a Significant Decrease of All Common Respiratory Viral Illnesses in Children

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## Abstract

To combat the spread of coronavirus disease 2019 (COVID-19), significant measures were enacted including school and business closures, social distancing, and facial coverings. We hypothesized that this would have an impact on all respiratory infections in children. Using nasopharyngeal panel test results of children in the emergency department, we evaluated cross-sectional data from February to May in both 2019 and 2020. Respiratory panel testing included 11 common respiratory viruses and bacteria. After the restrictions were enacted, we observed a large drop in the number and percentage positive of all common respiratory viral infections in 2020 compared with the same time in 2019. When analyzing data from children <2 years old, a similar decrease was seen. Restrictions enacted to prevent the spread of COVID-19 were associated with a significant decrease in respiratory viral infections in children of all ages. This association could guide future public health recommendations and guidelines.

## Keywords

respiratory infections, COVID-19 restrictions, pandemic, viral testing

## Introduction

As coronavirus disease 2019 (COVID-19) began to spread rapidly throughout the world, extreme efforts were made to slow the spread of the pandemic. This led to the introduction of public health mandates including social distancing, masking, hand washing, school closures, cancellation of mass events, and overall reduction of population movement. Studies from the beginning of the pandemic and from past respiratory epidemics have shown that distancing and facial coverings are associated with a decrease in the prevalence of respiratory illnesses including influenza, respiratory syncytial virus (RSV), parainfluenza, and adenovirus.<sup>1–8</sup> Studies of pediatric emergency department visits in the United Kingdom and Singapore showed that during lockdown, respiratory illnesses and breathing problems decreased significantly.<sup>9–11</sup> No studies have yet looked at the impact of COVID-19 restrictions on the incidence of all common respiratory infections in children. In the counties surrounding our hospital in California in the United States, restrictions were enacted beginning the second week of March of 2020. We theorized that these measures would lead to a

drop in some if not all respiratory infections. With the increased use of multiplex nucleic acid amplification swabs, we were able to perform this study evaluating the effect of COVID-19 restrictions on all common respiratory infections in our population.

## Materials and Methods

We performed a retrospective study of all nasopharyngeal respiratory panel results from patients <18 years of age in the pediatric emergency department between February 1 to May 31, 2019, and February 1 to May 31, 2020. The respiratory panel used is a nucleic acid amplification test that detects multiple pathogens in a

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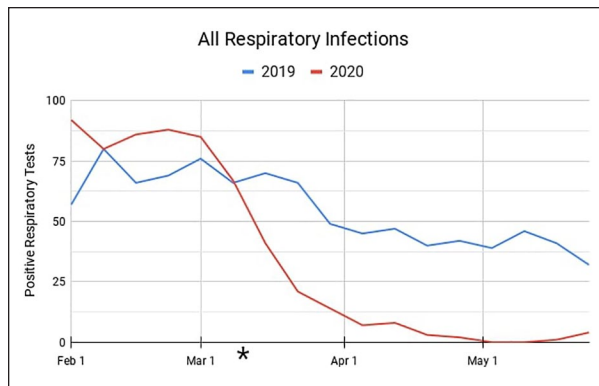
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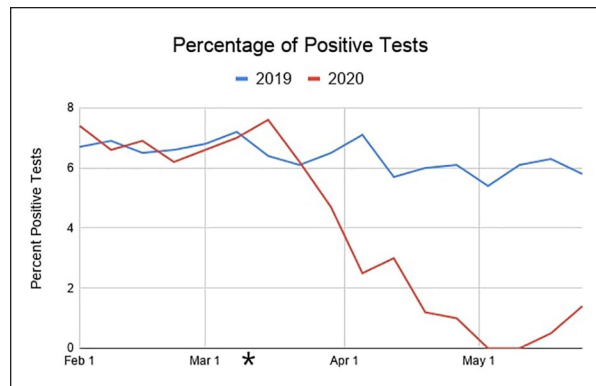
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**Figure 1.** The number of respiratory infections by week in 2019 compared with 2020. The asterisk denotes the time when coronavirus disease 2019 restrictions were begun.



**Figure 2.** The percentage of positive tests by week in 2019 compared with 2020. The asterisk denotes the time when coronavirus disease 2019 restrictions were begun.

single test. It includes the following respiratory infections: adenovirus, coronaviruses HKU1, NL63, 229E, OC43, metapneumovirus, rhinovirus or enterovirus, influenza A and B, parainfluenza virus types 1-4, RSV, *Bordetella pertussis*, *Bordetella parapertussis*, *Chlamydomphila pneumoniae*, and *Mycoplasma pneumoniae*. In our department, the test is performed on all patients admitted to the hospital for respiratory complaints. For patients who are discharged home, the test is performed at the discretion of the provider. We analyzed the data by weeks, with February 1 to 7 representing week 1, with a total of 17 weeks of data in both 2019 and 2020. This study was approved by our institutional review board.

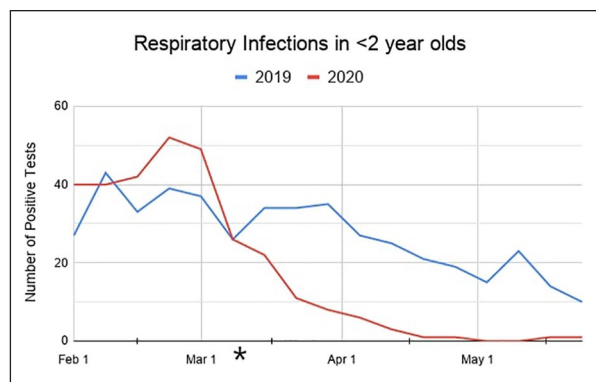
## Results

A total of 1321 respiratory panels (22457 individual tests) were ordered between February 1 and March 31 in 2019 versus 930 panels (15810 individual tests) ordered during the same weeks in 2020. There were 931 positive tests in 2019 versus 599 positive tests in 2020.

The number of positive tests in February and early March of 2020 mirrored or exceeded those in the same weeks of 2019. However, from late March onward, after the state restrictions were placed, the number of positive tests in 2020 were lower than in 2019 (Figure 1). The percentage of positive tests also decreased significantly after the middle of March in 2020 (Figure 2).

The number of bacterial infections (*Bordetella pertussis*, *Bordetella parapertussis*, *Chlamydomphila pneumoniae*, and *Mycoplasma pneumoniae*) was low during both years with a total of 12 infections in 2019 and 10 infections in 2020 during the study period.

When analyzing patients <2 years of age only, we observed a decrease in positive tests after the middle of



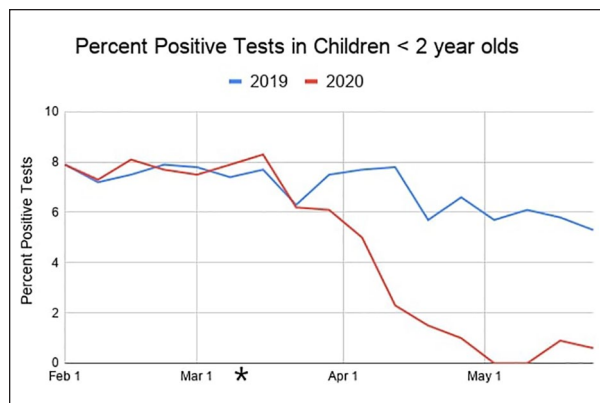
**Figure 3.** The number of respiratory infections in <2 year olds by week in 2019 compared with 2020. The asterisk denotes the time when coronavirus disease 2019 restrictions were begun.

March in 2020 compared with the same time in 2019 (Figure 3). The percentage of positive tests also decreased in this age group in 2020 compared with 2019 (Figure 4).

Comparison of weekly positive tests for adenovirus, non-COVID-19 coronaviruses, metapneumovirus, rhinovirus and enterovirus, influenza A and B, parainfluenza viruses, and RSV all showed decreases in 2020 after the COVID-19 restrictions were begun, compared with 2019 (online Supplementary File).

## Discussion

This study shows the association between the COVID-19 restrictions and a significant drop in all respiratory viral infections in children. With the concern that this finding could have been related to fewer tests being ordered, we also performed an analysis of the percentage of positive



**Figure 4.** The percentage of positive tests in <2 year olds by week in 2019 compared with 2020. The asterisk denotes the time when coronavirus disease 2019 restrictions were begun.

tests, which showed a similar decrease. We conclude that the findings are a significant change, likely the product of some or all the pandemic measures and less likely a result of yearly seasonal variation or decreased visits after lockdown. The same findings were also seen in the youngest children. Since it is less common for this age group to wear facial coverings, the observed drop in infections may be explained by social distancing alone versus the overall measures taken by older children and adults around them.

This information can influence public health measures in future pandemics, with early action potentially mitigating the impact of a global health crisis. These measures would be especially important in countries with limited resources where tenuous medical systems can be easily overwhelmed, and where there is more limited access to treatments and vaccines. Further studies are needed to decide which actions are most effective in stopping infectious spread: hand washing, facial coverings, social distancing, or school and business closures.

The information from this article can make significant impacts even during nonpandemic periods. Upper respiratory infections (URIs) have a significant negative economic impact, accounting for millions of missed work and school days due to illness.<sup>12,13</sup> RSV alone results yearly in 58 000 hospitalizations, 500 000 emergency department visits, and 2.1 million outpatient clinic visits in the United States.<sup>14</sup> URIs are also a significant cause of asthma exacerbations worldwide with asthma peaking yearly according to predictable patterns depending on the climate.<sup>15,16</sup> The annual cost of asthma care in the United States is estimated at >\$81 billion.<sup>17</sup> Changes to normal behavior such as enhanced hand-washing, facial coverings in public spaces, and social

distancing during the highest respiratory infectious seasons could significantly decrease the negative effects of frequent URIs and associated illnesses.

One question that remains unanswered is how this decrease in infections may influence the next few years. There is concern that with restrictions being eased, along with less infectious exposure this year with resulting lower population immunity, the following seasons may show a vulnerability to severe infections.<sup>8</sup>

A limitation to this study is that respiratory panel testing is not performed on every patient with respiratory or infectious symptoms in our emergency department. This study may represent patients that overall are sicker who may have different infection patterns than patients who did not receive testing. It is also possible that once restrictions were in place, physicians might have been motivated to order more respiratory testing than usual to find non-COVID-19 explanations for respiratory symptoms. This could have affected the percentage of positive respiratory testing; however, we feel that any effect was likely small.

Another limitation is that the numbers of bacterial infections were too low in both 2019 and 2020 to measure a difference. Further dedicated studies are needed to define the effect restrictions have on bacterial pneumonia.

## Conclusion

Restrictions enacted to prevent the spread of COVID-19 were associated with a significant decrease in respiratory viral infections in children of all ages. These findings should influence public health measures in future pandemics. Seasonal measures could also make a significant impact on the negative effects of respiratory infections during nonpandemic times. Further studies are needed to determine which measures make the most impact.

## Author Contributions

MMR analyzed the data, edited and wrote the manuscript, and formatted the figures.

FDH assisted with editing and writing the manuscript.

JRN assisted with formatting the figures.

BGC assisted with editing the manuscript.

MC assisted with editing the manuscript.

LAB: supervised the project and edited the manuscript.

## Declaration of Conflicting Interests

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## Supplemental Material

Supplemental material for this article is available online.

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