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K-12 COVID-19 CHILDHOOD TRANSMISSION SCIENTIFIC SUMMARY

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Data on childhood transmission of COVID-19 continues to evolve as more data emerges. Santa Clara County Public Health Department will continue to monitor emerging research and provide updated information.

How common is COVID-19 infection in children compared to adults?

Evidence suggests that there is a lower prevalence of COVID-19 infection among children than adults.

- Studies that include a representative sample of the population at one point in time (including in Iceland, Italy, Spain, and Sweden) suggest that COVID-19 is less prevalent among children than adults.
- There are many other (non-population-representative sampling) studies that likewise suggest children contract COVID-19 less frequently than adults. However, these studies in general are subject to several possible limitations: (a) children may be less likely to get tested or be diagnosed with COVID-19 because they are more likely to be asymptomatic or to have fewer or less severe symptoms and (b) there may be differences in the frequency of COVID-19 exposures faced by children (i.e. in areas where schools are closed and where they are open).
- In communities where COVID-19 is more prevalent, children (as well as adults) contract COVID-19 more frequently.
- An ongoing NIH study (HEROS or Human Epidemiology and Response to SARS-CoV-2) will offer additional evidence regarding the infectivity rate in children.

Are children less susceptible to becoming infected than adults?

If exposed to SARS-CoV-2 virus, children appear to be less likely to become infected.

- Many contact tracing studies (mostly looking within households) show that children have lower attack rates than adults. An attack rate is the proportion of exposed individuals who become infected. This means that when there is a case, children exposed to the case were less likely to become infected than adults who were exposed to the case.

Why do children appear to be less susceptible to becoming infected?

Currently, there are two main hypotheses as to why children appear to be less susceptible to becoming infected, and/or upon infection, less likely to be symptomatic.

- Different Expression of Ace-2 Inhibitors: Children have lower expression of angiotensin-converting enzyme 2 (ACE2) receptors, a protein on the cell surface that is important for COVID-19 to enter cells, in their respiratory tract.
- Greater Immune Responses: Children may have both a stronger and earlier immune response to COVID-19 infection than adults, in part because of exposure to other coronaviruses that cause the common cold.

Which children are most at risk of having severe COVID-19 disease?

Severe/critical illness and death are rare and occur most commonly, although not exclusively, in infants less than 1 year of age and children with underlying health problems.

Are children more (or less) likely than adults to transmit SARS-CoV-2 virus in households?

Younger children with COVID-19 appear to be less likely to transmit to household members, compared to older children and adults.

- Both large scale surveys (South Korea) and smaller studies of household clusters suggest that younger children (less than 10 years of age) are less likely to infect the adults in their household with COVID than vice versa. These conclusions are based on (a) the fact that children are less likely to be the index case in households and (b) the number of secondary cases in households where children are the index case.
- These studies are subject to several limitations: (a) inability to definitively define the direction of transmission in all situations, (b) the reduced likelihood that children will have symptoms (making them less likely to be identified as the index case), and (c) children are less likely to have first contact outside the household without adults present while schools are closed.

Are children more (or less) likely than adults to transmit SARS-CoV-2 virus in schools?

Data specific to the school setting are limited but suggest that staff-to-staff transmission is more common than child-to-staff or child-to-child transmission. The main studies, which come from Australia, England, and Germany, show that large school-based transmission events remain rare in elementary school-aged children, and staff-to-staff transmission is more common than staff-to-child or child-to-child transmission.

- Australia: [https://www.thelancet.com/journals/lanchi/article/PIIS2352-4642\(20\)30251-0/fulltext](https://www.thelancet.com/journals/lanchi/article/PIIS2352-4642(20)30251-0/fulltext)
- England: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/911267/School_Outbreaks_Analysis.pdf
- Germany: https://www.eurosurveillance.org/content/10.2807/1560-7917.ES.2020.25.38.2001645#html_fulltext

How common is child to adult transmission specifically in schools?

Scientific data are extremely limited but thus far suggest that there have been relatively few in-school transmissions. Where data are available, transmission has often been associated with a lack of masking in the school.

- Lessons from before school closures in March: Many studies throughout Europe, Australia, and Singapore showed no or few cases of transmission in the schools. In the few outbreaks that did occur (France, New Zealand, Chile) they occurred primarily in high schools. A few studies (in France and Chile) used antibody testing after documented outbreaks and found high seropositivity rates, suggesting possibility of more widespread transmission. However, there are many limitations to this antibody approach and there is little consensus on what these results actually mean.
- Lessons after school re-opening: The main published studies, which come from Australia, England, and Germany, all show that large school-based transmission events remain rare in elementary school-aged children and staff to staff transmission is more common than staff to child or child to child. A well-known high school outbreak in Israel has been attributed to crowded classrooms and lack of masking.
 - Australia: [https://www.thelancet.com/journals/lanchi/article/PIIS2352-4642\(20\)30251-0/fulltext](https://www.thelancet.com/journals/lanchi/article/PIIS2352-4642(20)30251-0/fulltext)

- England: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/911267/School_Outbreaks_Analysis.pdf
- Germany: https://www.eurosurveillance.org/content/10.2807/1560-7917.ES.2020.25.38.2001645#html_fulltext
- Israel: https://www.eurosurveillance.org/content/10.2807/1560-7917.ES.2020.25.29.2001352#html_fulltext

Additional reports regarding U.S. settings in media articles are listed below.

Transmission Resources for School Administrators:

[Insights for Education: COVID-19 and Schools: What We Can Learn from Six Months of Closures and Reopening \(10/1/20\): https://blooby.wsimg.com/go/104fc727-3bad-4ff5-944f-c281d3ceda7f/20201001_Covid19%20and%20Schools%20Six%20Month%20Report.pdf](https://blooby.wsimg.com/go/104fc727-3bad-4ff5-944f-c281d3ceda7f/20201001_Covid19%20and%20Schools%20Six%20Month%20Report.pdf)

WHO: What We Know About COVID Transmission in Schools (10/21/20): https://www.who.int/docs/default-source/coronaviruse/risk-comms-updates/update39-covid-and-schools.pdf?sfvrsn=320db233_2

Children’s Hospital of Pennsylvania Policy Review (11/5/2020):

<https://policylab.chop.edu/sites/default/files/pdf/publications/PolicyLab-Policy-Review-Evidence-Guidance-In-Person-Schooling-COVID-19-Nov-2020.pdf>

[UCSF Collaborative to Advise on Re-opening Education Safely \(CARES\) \(series of webinars on key topics including transmission\): https://coronavirus.ucsf.edu/cares](https://coronavirus.ucsf.edu/cares)

[A National Effort to Track School Opening Outcomes across the US \(data are limited\): https://covidschooldashboard.com/](https://covidschooldashboard.com/)

Key Media Articles

How schools across the globe are reopening amid the coronavirus pandemic. Ed Source. 6/30/20: <https://edsources.org/2020/how-schools-across-the-globe-are-reopening-amid-the-coronavirus-pandemic/634739>

School openings across globe suggest ways to keep coronavirus at bay, despite outbreaks. Science. 7/7/20: <https://www.sciencemag.org/news/2020/07/school-openings-across-globe-suggest-ways-keep-coronavirus-bay-despite-outbreaks?fbclid=IwAR2nFChOaDjBANWIEJvMsXPkjb5nwoMArhYgt2r7k1Jl5VGG7zPAuo15c1E>

What Scientists Know About How Children Spread COVID-19. Smithsonian. 7/23/20: <https://www.smithsonianmag.com/science-nature/what-scientists-know-about-how-children-spread-covid-19-180975396/>

Opening Schools Won’t Be Easy, but Here’s How to Do It Safely. NY Times. 7/29/20: <https://www.nytimes.com/2020/07/29/opinion/coronavirus-schools-reopen.html?action=click&module=Opinion&pgtype=Homepage>

What We Know About Coronavirus Cases in K-12 Schools So Far. NY Times. 9/21/20: https://www.nytimes.com/interactive/2020/09/21/us/covid-schools.html?action=click&module=Top%20Stories&pgtype=Homepage&fbclid=IwAR0L66EreqjcgCylWzvKEtJm_dUnH6Ry4RmWv9LK9pA8lp3pnr3e2oExfsU

Europe stays committed to in-person classes as school outbreaks remain rare. Washington Post. 9/27/20:
https://www.washingtonpost.com/world/europe/coronavirus-outbreaks-schools-europe/2020/09/27/Odd19bf6-ff48-11ea-b0e4-350e4e60cc91_story.html?fbclid=IwAR09wKDQRPfFXIRltkfBHjwnS0ndSWGvIPxHUIV3Hts2ldOxSUGZFihlaE

“Schools Aren’t Superspreaders”: Fears from the summer appear to have been overblown. The Atlantic. 10/9/20: <https://www.theatlantic.com/ideas/archive/2020/10/schools-arent-superspreaders/616669/>

Surprising Results in Initial Virus Testing in N.Y.C. Schools. NY Times. 10/19/20:
<https://www.nytimes.com/2020/10/19/nyregion/schools-coronavirus.html>

Are The Risks of Reopening Schools Exaggerated? NPR. 10/21/20:
<https://www.npr.org/2020/10/21/925794511/were-the-risks-of-reopening-schools-exaggerated>

‘Out of Control’: When Schools Opened in a Virus Hot Spot. NY Times. 10/22/20:
<https://www.nytimes.com/2020/10/18/us/coronavirus-schools-reopening-outbreak.html>

Schoolchildren Seem Unlikely to Fuel Coronavirus Surges, Scientists Say. NY Times. 10/22/20:
<https://www.nytimes.com/2020/10/22/health/coronavirus-schools-children.html>

Why Is Europe Keeping Its Schools Open, Despite New Lockdowns?. NY Times. 10/29/20:
https://www.nytimes.com/2020/10/29/world/europe/schools-coronavirus-europe-lockdowns.html?campaign_id=174&emc=edit_csb_20201113&instance_id=24090&nl=coronavirus-schools-briefing®i_id=81377326&segment_id=44450&te=1&user_id=f6587adf14ca26f2b457482714e452fb

Lessons From Europe, Where Cases Are Rising But Schools Are Open. NPR. 11/13/20:
https://www.npr.org/2020/11/13/934153674/lessons-from-europe-where-cases-are-rising-but-schools-are-open?campaign_id=174&emc=edit_csb_20201113&instance_id=24090&nl=coronavirus-schools-briefing®i_id=81377326&segment_id=44450&te=1&user_id=f6587adf14ca26f2b457482714e452fb&utm_campaign=storyshare&utm_medium=social&utm_source=twitter.com