EDITORIAL

Reopening schools during COVID-19

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Coronavirus disease 2019 (COVID-19) is upending education. Operating schools during the pandemic entails balancing health risks against the consequences of disrupting in-person learning. In the United States, plans differ among states as schools have already reopened or plan to reopen. Scientific understanding of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2, the cause of COVID-19) should inform how schools reopen.

Although school children and adolescents (ages 3 to 18 years) can develop COVID-19, most remain asymptomatic or experience mild illness. These youngsters may be less susceptible to infection than older individuals but probably spread the infection at similar rates. SARS-CoV-2 infections in children and adolescents are rising faster than in other age groups as restrictions have been eased. Infections have been imported into schools from the community. But further transmission within schools has been rare when rigorous measures have been implemented to reduce the risk of person-to-person spread. Larger school outbreaks are associated with increased community transmission, insufficient physical distancing, poor ventilation, and lack of masking. Schools that implemented transmission mitigation measures (including in European countries) seem not to have substantially contributed to increased circulation of the virus among local communities.

> **"The evidence thus far points to three mitigation strategies for reopening."**

What can schools do? The evidence thus far points to three mitigation strategies for reopening.

Minimizing the import of infections into the school can stem the spread of COVID-19. Daily symptom screening can identify individuals with COVID-19 at first presentation. They should seek diagnostic testing. However, infections can be silent. Approximately 15 to 50% of children and 10 to 30% of adults will either not notice symptoms while their immune system fights the infection (asymptomatic carriers) or become infectious 1 to 3 days before symptom onset (presymptomatic carriers). Current diagnostic tests cannot identify silent infections reliably and are not sufficiently fast and inexpensive to make a school-wide testing-based surveillance system practical. Thus, the most effective tool for minimizing the risk of infections being carried into schools is to restrict in-person learning to when infection in the local community is controlled. Countries with widespread testing began opening schools with rigorous safety measures in place when fewer than 30 to 50 new infections were observed within 7 days per 100,000 residents over a prolonged period. Countries providing in-person schooling with basic mitigation measures (i.e., distancing, face masks worn in hallways but not classrooms, hand hygiene, ventilation, and staying home with minimal symptoms) typically have close to zero community transmission.

The likelihood of further transmission must be minimized if infections are brought into school. COVID-19 is spread through liquid particles containing the virus that are generated by breathing, speaking, shouting, singing, coughing, and sneezing. The rapid settling rate of large droplets underlies recommendations for physical distancing, surface disinfection, ventilation, and hand hygiene. Because smaller liquid particles dispersed as aerosols stay airborne, it is not only the distance from another person that determines the risk of transmission, but also the duration of exposure. Limiting room occupancy, avoiding activities such as singing, and improving ventilation are critical in transmission control. Masks reduce spread by droplets and aerosols by limiting release and inhalation. Airborne spread is much less likely outdoors, but sports, where proximity to excessive exhalation is intrinsic to the game, need to be avoided.

Large outbreaks in school can be minimized by limiting secondary transmission to the smallest possible number of persons. Cohorts that remain relatively isolated from each other can reduce person-to-person contact and can facilitate contact tracing if outbreaks occur. Early detection of infected individuals through symptom surveillance and diagnostic testing can limit quarantine measures to the affected cohorts, rather than having to close grades or the entire school.

From these three efforts, a layered approach to risk mitigation in schools can be developed where measures with partial effectiveness are combined to reduce the probability of children, teachers, staff, and family members becoming ill with COVID-19.*

The lower the infection rate in the community, the less stringent other risk mitigation measures need to be. If communities prioritize suppressing viral spread in other social gatherings, then children can go to school.

–Ronan Lordan, Garret A. FitzGerald, Tilo Grosser

*The figure is available in the supplementary materials (science.sciencemag.org/content/369/6508/1146/suppl/DC1).

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