School openings across the globe suggest ways to keep coronavirus at bay, despite outbreaks [1]

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EXCERPTS

Early this spring, school gates around the world slammed shut. By early April, an astonishing 1.5 billion young people were staying home as part of broader shutdowns to protect people from the novel coronavirus. The drastic measures worked in many places, dramatically slowing the spread of SARS-CoV-2, the virus that causes COVID-19.

However, as weeks turned into months, pediatricians and educators began to voice concern that school closures were doing more harm than good, especially as evidence mounted that children rarely develop severe symptoms from COVID-19. (An inflammatory condition first recognized in April, which seems to follow infection in some children, appears uncommon and generally treatable, although scientists continue to study the virus' effect on youngsters.)

Continued closures risk "scarring the life chances of a generation of young people," according to an open letter published this month and signed by more than 1500 members of the United Kingdom's Royal College of Paediatrics and Child Health (RCPCH). Virtual education is often a pale shadow of the real thing and left many parents juggling jobs and childcare. Lower-income children who depend on school meals were going hungry. And there were hints that children were suffering increased abuse, now that school staff could no longer spot and report early signs of it. It was time, a growing chorus said, to bring children back to school.

By early June, more than 20 countries had done just that. (Some others, including Taiwan, Nicaragua, and Sweden, never closed their schools.) It was a vast, uncontrolled experiment.

Some schools imposed strict limits on contact between children, while others let them play freely. Some required masks, while others made them optional. Some closed temporarily if just one student was diagnosed with COVID-19; others stayed open even when multiple children or staff were affected, sending only ill people and direct contacts into quarantine.

Data about the outcomes are scarce. "I just find it so frustrating," says Kathryn Edwards, a pediatric infectious disease specialist at the Vanderbilt University School of Medicine who is advising the Nashville school system, which serves more than 86,000 students, on how to reopen. Her research assistant spent 30 hours hunting for data—for example on whether younger students are less adept at spreading the virus than older ones, and whether outbreaks followed reopenings—and found little that addressed the risk of contagion in schools.

When Science looked at reopening strategies from South Africa to Finland to Israel, some encouraging patterns emerged. Together, they suggest a combination of keeping student groups small and requiring masks and some social distancing helps keep schools and communities safe, and that younger children rarely spread the virus to one another or bring it home.

"Outbreaks in schools are inevitable," says Otto Helve, a pediatric infectious disease specialist at the Finnish Institute for Health and Welfare. "But there is good news." So far, with some changes to schools' daily routines, he says, the benefits of attending school seem to outweigh the risks—at least where community infection rates are low and officials are standing by to identify and isolate cases and close contacts.

How likely are children to catch and transmit the virus?

Several studies have found that overall, people under age 18 are between one-third and one-half as likely as adults to contract the virus, and the risk appears lowest for the youngest children. The reason remains the subject of intense study. But the town of Crépy-en-Valois, home to 15,000 people on the northern outskirts of Paris, provides some confirmation that younger age reduces risk of infection—and transmission.

When two high school teachers developed minor respiratory symptoms in early February, no one suspected COVID-19. It was cold and flu season, and health officials still assumed the novel coronavirus was mostly confined to China. It wasn't until 25 February, after one of their contacts was hospitalized in Paris, that the teachers realized they had been infected with SARS-CoV-2. For at least 12 days before the start of winter break on 14 February, and before France instituted precautionary measures, the virus had been spreading freely at the school.

Arnaud Fontanet, an epidemiologist at the Pasteur Institute, and his colleagues started an investigation in Crépy-en-Valois in late March to see whether they could piece together the virus' reach in the town and its schools. In the high school, antibody testing showed that 38% of pupils, 43% of teachers, and 59% of nonteaching staff had been infected. (By then, several people associated with the school had been hospitalized with COVID-19 complications.) In six elementary schools, they found a total of three children who had caught the virus, likely from family members, and then attended school while infected. But, as far as the researchers could tell, those younger children didn't pass the virus on to any close contacts.

"It's still a bit speculative," says Fontanet, who shared results from the high school on 23 April and from the elementary schools on 29 June, both on the preprint server medRxiv. But high school students "have to be very careful. They have mild disease, but they are contagious." Children younger than 11 or 12, on the other hand, "probably don't transmit very well. They are close to each other in schools, but that is not enough" to fuel spread. At the same time, scientists note that children have more contacts than adults, especially at school, which could offset the lower odds they will spread the pathogen.

Other outbreaks also suggest that elementary school pupils pose a smaller threat than older students. Among the worst schoolwide outbreaks was at Gymnasium Rehavia, a middle and high school in Jerusalem, where 153 students and 25 staff were infected in late May and early June. An outbreak at a New Zealand high school before that country's shutdown infected 96 people, including students, teachers, staff, and parents. In contrast, a neighboring elementary school saw few cases.

But the picture is still blurry. Another Israeli outbreak was in an elementary school in Jaffa, with 33 students and five staff members affected. Across the globe, an elementary school classroom in Trois-Rivières, Canada, had nine of 11 students infected after one contracted the virus in the community.

Other data come from day care centers: In many countries, they stayed open for children of essential workers, and outbreaks appeared rare. Two flares in Canadian day cares—one in Toronto, and one outside of Montreal—led to temporary closures. In Texas, where overall cases have skyrocketed, at least 894 preschool staff and 441 children across 883 facilities have tested positive, according to news reports. That's up from 210 total cases just a few weeks ago.

Tracing transmission through schools, one student at a time—as Fontanet and his colleagues did—should help elucidate whether the virus tracks differently in children of different ages. Another clue about age-based spread came from Crépy-en-Valois's timeline of new infections. Among high school students and staff, new infections dropped off sharply once winter break started. But in the elementary schools, the (already low) rate of new cases held steady. Fontanet says that pattern suggests that while high schoolers were catching the virus at school, the younger pupils caught it from family members and not their classmates.

Should children play together?

The scenes hardly resemble typical school: Preschool children instructed to spend recess playing alone inside a chalk square. Eight-year-olds told not to speak to their friends. Middle schoolers reminded to steer clear of classmates when entering or leaving the building.

As schools reopened, many embraced physical distancing for students to prevent viral spread. But although the strategy is effective, it is leaving more and more scientists, pediatricians, and parents deeply uncomfortable. They hunger for a compromise that protects communities from COVID-19 while supporting the mental health of young people. "There has to be a level of risk that we're willing to take if a child's in school" says Kate Zinszer, an epidemiologist at the University of Montreal.

Schools are "where our children run around, play and laugh and argue with each other. They need to return to that sort of a healthy normality as soon as possible," Russell Viner, RCPCH's president said in a statement last month.

From the start, some countries bet on strands of research suggesting young children are unlikely to spread the virus: schools in the Netherlands cut class sizes in half but didn't enforce distancing among students under age 12 when they reopened in April. Other schools adopted a "pod" model as a compromise. Denmark, the first country in Europe to reopen schools, assigned children to small groups that could congregate at recess. It also found creative ways to give those groups as much space and fresh air as possible, even teaching classes in a graveyard. Some classes in Belgium met in churches to keep students spread out. Finland has kept normal class sizes, but prevents classes from mixing with one another.

As spring wore on, many other countries began rethinking distancing in schools. The Canadian province of Quebec, which reopened many elementary schools in May with strict distancing, has announced fall plans that allow children to socialize freely in groups of six; each group must stay 1 meter away from other groups of students and 2 meters away from teachers. Although French preschoolers were photographed sitting inside their own recess squares in May, day cares there have now abandoned all distancing rules for children ages 5 and under. Older students are advised to stay at least 1 meter away from others while inside. But outside they can play freely with others in their class. The Netherlands recently announced that anyone under age 17 does not need to distance.

The change is driven not just by pediatricians' advice but also by practicalities: A full school building leaves little room for distancing. In Israel, pressure to return everyone to school after a partial reopening on 3 May was intense. Two weeks later, classrooms welcomed back all students, housing their usual 30 to 40 pupils. Distancing in class was impossible, says Efrat Aflalo of Israel's Ministry of Health. So the country embraced another protective strategy: masks.

Should kids wear masks?

Masks likely blunt spread at school, but children—even more than adults—find them uncomfortable to wear for hours and may lack the self-discipline to wear them without touching their faces or freeing their noses. Does discomfort override a potential public health benefit?

“For me, masks are part of the equation” for slowing the spread of COVID-19 in schools, especially when distancing is difficult, says Susan Coffin, an infectious disease physician at the Children’s Hospital of Philadelphia. “Respiratory droplets are a major mode of [virus] transmission,” she says, and wearing a mask places an obstacle in those droplets’ path.

In China, South Korea, Japan, and Vietnam—where masks are already widely accepted and worn by many during flu season—schools require them for almost all students and their teachers. China allows students to remove masks only for lunch, when children are separated by glass or plastic partitions. Israel requires masks for children older than age 7 outside the classroom, and for children in fourth grade and above all day—and they comply, says Aflalo, who has 8- and 11-year-old boys. On the bus ride to school, “all the kids are sitting with masks on,” she says. “They don’t take them off. They listen to the orders.”

Elsewhere, masks are less central. In some schools in Germany, students wear them in hallways or bathrooms, but can remove them when seated at their (distantly spaced) desks. Austria reopened with this approach, but abandoned masks for students a few weeks later, when officials observed little spread within schools. In Canada, Denmark, Norway, the United Kingdom, and Sweden, mask wearing was optional for both students and staff.

Not all countries have the luxury of instituting a mask policy driven by science and comfort. Benin requires masks in public spaces, but because the cost can be prohibitive for families, schools do not turn maskless students away. Students in Ghana returned to school in May wearing masks—if they had them. South Africa, which faces a rising COVID-19 caseload, is racing to provide free masks to all students who need them.

For Aflalo, the potential value of masks was underscored after a record-setting heat wave struck Israel in mid-May. As temperatures rose to 40°C, masks became intolerable, and with the health ministry’s blessing, students and teachers largely put them aside for almost a week.

For 2 weeks—the typical COVID-19 incubation period—things seemed fine. Aflalo left to go camping in the desert with her family. But then, a crisis: While on vacation, “I started getting calls about the Gymnasium,” says Aflalo, referring to Gymnasium Rehavia, the school in Jerusalem with the large outbreak. Aflalo can’t say for sure that the outbreak was fueled by a lack of masks, but she believes the timing is suggestive.

What should schools do when someone tests positive?

The short answer: No one knows. That’s largely because of a lack of data about how many silent cases might be brewing when an illness or two comes to light. “How do we best deal with infection?” Edwards wonders. “Do we just close the classroom” or shutter the whole school?

Some schools have favored isolating only close contacts. In Germany, for example, classmates and teachers of an infected student are sent home for 2 weeks, but other classes continue. Until summer break, Quebec generally did the same; at least 53 students and teachers tested positive after many schools reopened in May, according to news reports, but officials believed many of those infections were contracted in the community.

Do schools spread the virus to the wider community?

Because children so rarely develop severe symptoms, experts have cautioned that open schools might pose a much greater risk to teachers, family members, and the wider community than to students themselves. Many teachers and other school staff are understandably nervous about returning to the classroom. In surveys of U.S. school districts, as many as one-third of staff say they prefer to stay away. Science could find few reports of deaths or serious illnesses from COVID-19 among school staff, but information is sparse. Several teachers have died of COVID-19 complications in Sweden, where schools did not modify class sizes or make other substantive adjustments.

Early data from European countries suggest the risk to the wider community is small. At least when local infection rates are low, opening schools with some precautions does not seem to cause a significant jump in infections elsewhere.

It’s hard to be sure, because in most places, schools reopened in concert with other aspects of public life. But in Denmark, nationwide case numbers continued to decline after day care centers and elementary schools opened on 15 April, and middle and high schools followed in May. In the Netherlands, new cases stayed flat and then dropped after elementary schools opened part-time on 11 May and high schools opened on 2 June. In Finland, Belgium, and Austria, too, officials say they found no evidence of increased spread of the novel coronavirus after schools reopened.

Elsewhere, officials are more cautious. Taiwan, which has largely suppressed the virus, kept schools open after one case but said it would close them for two or more, a situation it hasn’t yet faced. In Israel, schools closed for a single case, and close contacts of every infected individual were tested and quarantined, Aflalo says. By mid-June, 503 students and 167 staff had been infected, and 355 schools had closed temporarily. (That number is a small fraction of the 5000 schools across Israel.)

Widespread testing in schools, including of children without symptoms, could help officials choose the most effective policy. The U.K. government recently began a study of as many schools as it can recruit across England. The project will test students and staff at preschools, primary schools, and secondary schools several times over at least 6 months for both the virus and antibodies to it, in an effort to map transmission patterns and viral prevalence. In Berlin, researchers from Charité University Hospital launched a study in 24 schools on 15 June—2 weeks before summer break—that will test a cohort of 20 to 40 pupils and five to 10 staff members from each school every 3 months for at least 1 year. The researchers will look for both active infections and antibodies, to map the extent of silent infections and the threat they pose to students and staff. A similar study started this week in 138 preschools and elementary schools across the state of Bavaria.

In a broader study of COVID-19 clusters worldwide, epidemiologist Gwen Knight at the London School of Hygiene & Tropical Medicine and her colleagues collected data before most school closings took effect. If schools were a major driver of viral spread, she says, “We would have expected to find more clusters linked to schools. That’s not what we found.” Still, she adds, without widespread testing of young people, who often don’t have symptoms, it’s hard to know for sure what role schools might play.

At the same time, open schools can change the overall balance of who becomes infected by adding cases among children. In Germany, the proportion of all new infections that were in children under age 19 ticked upward from about 10% in early May, when schools reopened, to nearly 20% in late June. But wider testing and a decline in cases among the elderly could also explain the increase. In Israel, infections among children increased steadily after schools opened. That paralleled a rise in cases nationwide, but it’s not clear whether the country’s rising caseload contributed to the increase within schools or vice versa.

“We try to focus the epidemiologic research and find the source but it’s hard,” Aflalo says. “We cannot say right now this is because of this or that.”

What lies ahead?

In much of the world, schools that closed in March remained closed through the summer break, and autumn will see a wave of reopenings. For millions of especially vulnerable children, however, the break may continue indefinitely. Many low-income countries lack the resources to shrink class sizes or provide everyone with masks and so are hesitant to reopen in the midst of a pandemic. In June, Bangladeshi Prime Minister Sheikh Hasina said schools will likely stay shut until the danger of COVID-19 has passed. Similarly, officials in the Philippines said in-person schooling will not resume until there is a vaccine to protect against COVID-19.

In other places, ranging from Mexico to Afghanistan to the United States, planning for fall 2020 is underway. In the United States, school districts are releasing a patchwork of plans, which often include hybrid models that alternate distance learning with small in-person classes.

The experiment will continue. Yet scientists lament that as before, it may not generate the details they crave about infection patterns and paths of transmission. “There just isn’t really a culture of research” in schools, Edwards says. Gathering data from schoolchildren comes with layers of complexity beyond those of traditional pediatric research. In addition to seeking consent from parents and children, it often requires buy-in from teachers and school administrators who are already overwhelmed by their new reality. Integrating research—the only sure way to gauge the success of their varied strategies—may be more than they can handle.

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