SCHOOLS FOR HEALTH

Risk Reduction Strategies for Reopening Schools

COVID-19

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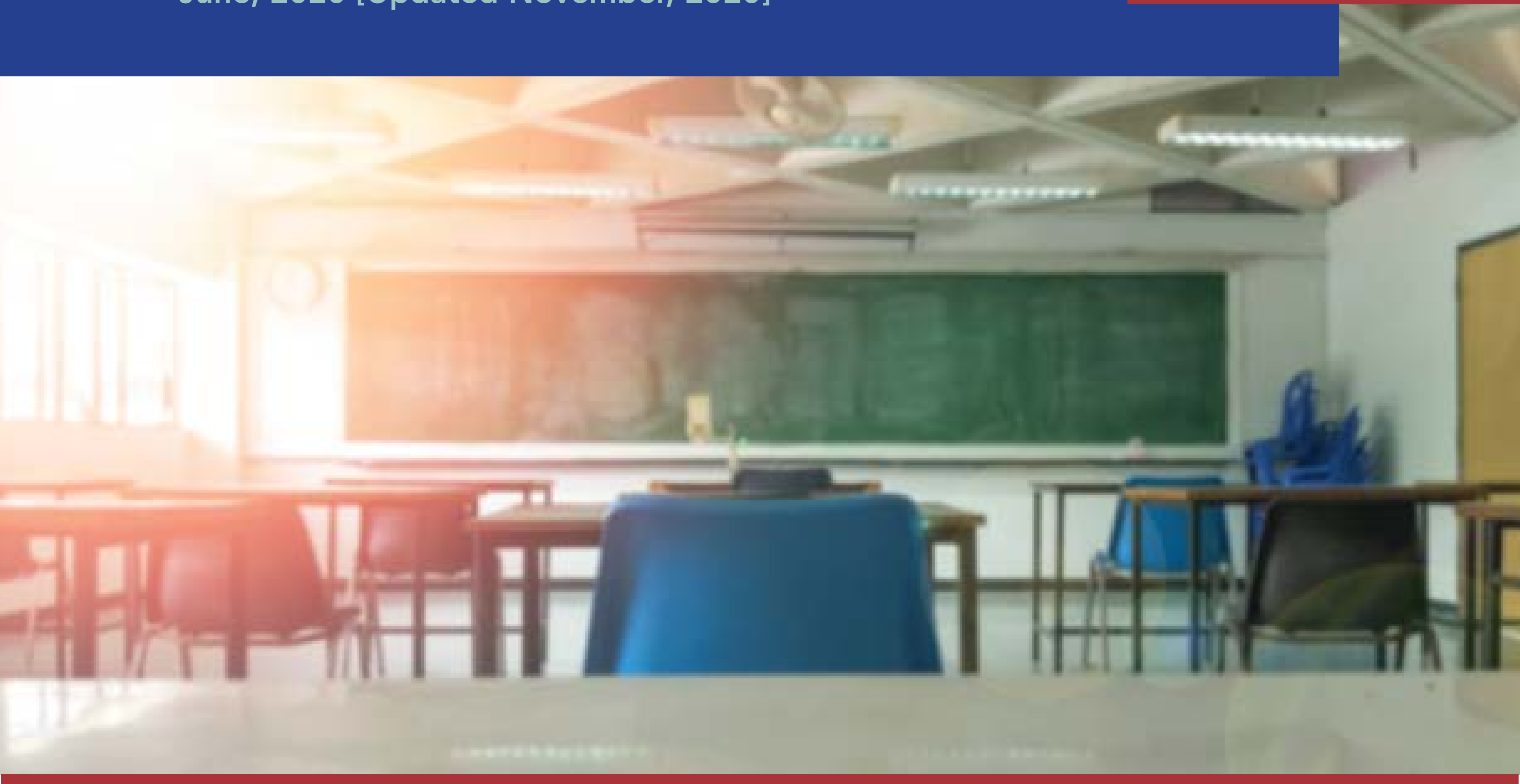

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Risk Reduction Strategies for Reopening Schools

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This report on Risk Reduction Strategies for Reopening Schools is provided for informational and educational purposes only. It is intended to offer guidance regarding best practices regarding the general operations of buildings in an effort to reduce the risk of disease transmission, specifically novel coronavirus SARS-CoV-2 and the disease it causes, COVID-19. Adherence to any information included in this report will not ensure successful treatment in every situation, and user acknowledges that there is no “zero risk” scenario. User acknowledges that each building and situation are unique and some of the guidance contained in the report will not apply to all buildings or countries outside the United States. Furthermore, the report should not be deemed inclusive of all proper methods nor exclusive of other methods reasonably directed to obtaining the same results. The report is in no way intended to override or supersede guidance from government and health organizations, including, without limitation, the Centers for Disease Control and Prevention, the World Health Organization, the United States Government, and or any States. The information contained herein reflects the available information at the time the report was created. User recognizes that details and information are changing daily, and new information and/or the results of future studies may require revisions to the report (and the general guidance contained therein) to reflect new data. We do not warrant the accuracy or completeness of the guidance in this report and assume no responsibility for any injury or damage to persons or property arising out of or related to any use of the report, or for any errors or omissions.

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EXECUTIVE SUMMARY

Keeping schools open needs to be prioritized.

Keeping schools closed comes with massive, long-term individual and societal costs. Many children cannot effectively learn, grow, engage, socialize, be active, eat healthy food, or get support until schools reopen. With schools closed, disparities are widening across racial and ethnic groups, between women and men, and across income levels. Many parents and caregivers cannot fully go back to work until children go back to school.

Children are at much lower risk from COVID-19 than adults and a growing body of scientific evidence shows that kids and adults can be kept safe in any indoor environment, including schools, if appropriate risk reduction measures are implemented.

With this as the backdrop, we set out to answer this question: what strategies should schools consider to reduce risk of COVID-19 transmission?

Note that a risk reduction strategy is different from a goal of achieving zero cases. There is no such thing as 'zero risk' in anything we do, and certainly not during a pandemic.

However, scientific evidence indicates that risks to students and staff can be kept low if schools adhere to strict control measures and dynamically respond to potential outbreaks.

We recognize there are immense challenges. There is no perfect plan to reopen schools safely, only 'less bad' options. There is no 'one size fits all' strategy that works for every school. Schools have limited budgets and staff. Compliance may be imperfect. Learning will be different. There will be disruption. Schools may need to change course unexpectedly depending on local conditions.

Despite these challenges, the enormous individual and societal costs of keeping schools closed compels us, a team focused on Healthy Buildings and exposure and risk science, to present a range of control strategies that should be considered in discussions of school reopenings:

HEALTHY CLASSROOMS: Following safe practices in classrooms

HEALTHY BUILDINGS: Breathing clean air in the school building

HEALTHY POLICIES: Building a culture of health, safety, and shared responsibility

HEALTHY SCHEDULES: Moving between rooms and locations safely

HEALTHY ACTIVITIES: Enjoying modified activities

These strategies work together as part of a holistic, multi-layered plan to reduce exposure to and limit transmission of COVID-19 in schools. Schools should adopt and adapt these recommendations to best fit their unique situation, depending on available personnel, resources, finances, school demographics, and building attributes. In addition, schools should frequently revisit their approach as the COVID-19 situation changes over time in each community.

For additional resources related to schools and COVID-19, visit our Harvard Healthy Buildings program website dedicated to schools: https://schools.forhealth.org/

HEALTHY BUILDINGS

- Increase outdoor air ventilation
- Filter indoor air
- Supplement with portable air cleaners
- Verify ventilation and filtration performance
- Consider advanced air quality techniques
- Use plexiglass as physical barrier
- Install no-contact infrastructure
- Keep surfaces clean
- Focus on bathroom hygiene

HEALTHY CLASSROOMS

- Wear masks
- Wash hands frequently
- Maximize physical distancing to protect individuals
- Maximize group distancing to slow transmission chains
- Limit sharing of objects

HEALTHY ACTIVITIES

- Provide recess
- Modify physical education
- Reimagine music and theater classes
- Continue sports with enhanced controls
- Add structure to free time

HEALTHY SCHEDULES

- Manage transition times and locations
- Make lunchtime safer
- Rethink transportation
- Modify attendance

HEALTHY POLICIES

- Establish and reinforce a culture of health, safety, and shared responsibility
- Form a COVID-19 response team and plan
- Prioritize staying home when sick
- Promote viral testing
- Establish plans for when there is a case
- Support remote learning options
- De-densify school buildings
- Protect high-risk students and staff

HEALTHY CLASSROOMS

Wear masks

- All students, teachers, administrators, and visitors must wear face masks indoors
- Train students and staff on how to wear and care for masks
- Ensure masks meet effectiveness criteria
- Build in short times throughout the day when students and staff don't have to wear masks

Wash hands frequently

- Wash hands immediately before: leaving home, leaving the classroom, eating, touching shared objects, touching one's face, and leaving school
- Wash hands immediately after: arriving at school, entering classroom, finishing lunch, touching shared objects, using the bathroom, coughing, sneezing, and blowing one's nose, and arriving at home
- Use hand sanitizer containing at least 60% ethanol or 70% isopropanol when washing hands is not possible

Maximize physical distancing to protect individuals

- Aim for six feet between individuals, as much as possible, for as long as possible; if everyone is masked in the classroom, maintaining three-foot distancing is acceptable
- Repurpose other large, unused spaces in the school as temporary classrooms (e.g., auditorium)
- Move class outdoors if possible
- Replace hugs, handshakes, and high-fives with smiles, waves, and thumbs-ups

Maximize group distancing to slow transmission chains

- Keep class groups as distinct and separate as possible
- Limit students moving between different classrooms
- Avoid large groups and gatherings, both in and out of school

Limit sharing of objects

- Choose lesson plans that limit student contact
- Provide students with their own separate supplies when possible
- Provide disposable disinfectant wipes for individuals to use before using shared objects

HEALTHY BUILDINGS

Increase outdoor air ventilation

- Bring in more fresh outdoor air

Filter indoor air

- Increase the level of the air filter to MERV 13 or higher on recirculated air
- Inspect filters to make sure they are installed and fit correctly
- Check that sufficient airflow can be maintained across the filter
- Maintain and change filters based on manufacturer's recommendation

Supplement with portable air cleaners

- Supplement ventilation and filtration with air cleaning devices
- Select portable air cleaners with HEPA filters
- Size devices carefully based on the size of the room

Verify ventilation and filtration performance

- Verify through commissioning and testing
- Work with an expert to evaluate building systems, ventilation, filtration, and air cleaning
- Measure carbon dioxide (CO_2) as a proxy for ventilation

Consider advanced air quality techniques

- Attempt to maintain indoor relative humidity between 40-60%
- Consider advanced air cleaning with ultraviolet germicidal irradiation (UVGI)

Use plexiglass as physical barrier

- Install plexiglass shielding in select areas with fixed interactions (e.g., reception desk, cafeteria checkout)
- Check the air mixing and interzonal air flows in indoor environments to ensure the plexiglass does not alter ventilation in some areas

Install no-contact infrastructure

- Adjust existing infrastructure to make it touchless
- Install touchless technology for dispensers of hand soap, hand sanitizer, and paper towels

Keep surfaces clean

- Frequently clean and disinfect surfaces following directions on product labels
- Provide adequate training and properly-sized personal protective equipment to protect custodial staff

Focus on bathroom hygiene

- Keep bathroom doors and windows closed and run any exhaust fans at all times
- Install lids on all toilet seats, if possible, and keep the lids closed during flushing
- Stagger bathroom use

HEALTHY POLICIES

Establish and reinforce a culture of health, safety, and shared responsibility

- Provide training to teachers, staff, students, and parents/guardians
- Start each day with a morning message to the entire school reinforcing health messaging
- Create and display signs around the school as reminders of rules, roles, and responsibilities
- Hold weekly and monthly all-staff meetings on COVID-19 to evaluate control strategies
- Send out weekly reports and reminders to parents and students of their respective roles
- Reward good behavior
- Encourage behaviors that reduce the risk of contracting COVID-19 outside of school hours

Form a COVID-19 response team and plan

- Have a person or team in charge of implementing and disseminating COVID-19 policies
- Implement contact tracing to notify class groups if they may have been exposed
- Ensure staff are aware of privacy policies regarding disclosure of COVID-19 status
- Increase staff surge capacity if possible by recruiting student teachers, substitute teachers, community volunteers, and/or recent retirees

Prioritize staying home when sick

- Ask students and school staff to stay home when not feeling well
- Request daily self-declaration that people heading into school are free of symptoms
- Identify a comfortable room where individuals who become ill can isolate for the rest of the school day

Promote viral testing

- Encourage viral testing any time someone has symptoms, even if mild
- Track testing improvements and incorporate widescale frequent testing of the general school population into future plans
- Provide information on where people can go for testing

Establish plans for when there is a case

- Develop a plan for what to do when a case is identified in the school
- Establish a timetable for when someone with COVID-19, and their close contacts, can return to school
- Regularly check CDC guidance for updates to their protocols and definitions

HEALTHY POLICIES

Support remote learning options

- Provide necessary supplies and support systems to continue remote education for students staying home
- Train staff on how to best facilitate remote learning
- Consider district-wide remote learning by grade, staffed by recent retirees or teachers with pre-existing conditions

De-densify school buildings

- Limit parent and visitor access
- Move parent-teacher conferences online
- Promote work-from-home for administrative duties, where possible
- Hold staff meetings via videoconferencing as much as possible

Protect high-risk students and staff

- Advocate for high-risk students and staff to have access to effective remote learning or work
- Re-assign roles if needed to allow staff members to work while staying safe
- Take extra precautions if high-risk students or staff come to school

HEALTHY SCHEDULES

Manage transition times and locations

- Stagger school arrival and departure times, class transitions, and locker access
- Set up separate entrances and exits for different groups of students when possible
- Use well-marked lines on the floor to encourage physical distancing and indicate direction of travel

Make lunchtime safer

- Use student classrooms or other school locations as temporary lunchrooms to facilitate group distancing
- Stagger lunchtimes in shared lunchrooms and clean and disinfect surfaces between groups
- Maintain physical distance between individuals eating lunch together
- Package school-provided meals in single-serving containers instead of serving food buffet-style
- Reinforce 'no sharing' of food, utensils, drinks
- Enhance engineering controls for times when masks are not worn

Rethink transportation

- Open all windows on the bus, even a little, and even in bad weather
- Reduce the number of students in each school bus to allow for physical distancing, if possible
- Modify school start times to allow students who use public transit to avoid rush hour
- Encourage walking, biking, or use of personal vehicles

Modify attendance

- Modify attendance policies to facilitate cleaning, reduce class sizes, and/or maintain group and physical distancing
- Allow for flexibility in attendance policies as situations change
- Modify attendance if community spread metrics exceed targets before moving to a fully remote learning platform, and prioritize in-person learning for youngest grades

HEALTHY ACTIVITIES

Provide recess

- Do not limit children's access to recess, the schoolyard, or fixed play equipment
- Wash or sanitize hands before and after recess or using high-touch equipment
- Increase supervision to limit high-risk behaviors
- Stagger recess times, or, if necessary, separate classes by schoolyard area

Modify physical education

- Hold physical education classes outdoors when possible
- Modify activities to limit the amount of shared equipment
- Choose activities that limit close contact over those with a high degree of personal interaction
- Limit use of locker rooms

Reimagine music and theater classes

- Replace higher-risk music and theater activities with safer alternatives
- Move outdoors
- Increase space between performers

Continue sports with enhanced controls

- Offer every sport if the right controls are in place
- Play outdoors as much as possible
- Limit time spent in close contact and in big groups
- Limit shared equipment, shared spaces, and the number of contacts of the team
- Modify the season schedule and restrict game attendance if feasible
- Analyze each element of practices and games to identify ways to reduce risk
- Wear masks
- Wash or sanitize hands before and after practice, games, or using high-touch equipment

Add structure to free time

- Establish occupancy limits and clear physical distancing guidelines in common spaces like a library or cafeteria
- Encourage students to remain outside when not in class
- Replace unstructured time with supervised study halls, if feasible

INTRODUCTION AND BACKGROUND

THE CHALLENGE BEFORE US

These are extraordinary times.

When the COVID-19 pandemic hit the United States in force in March 2020, every state closed its schools in response, disrupting the education of over 60 million children. Globally, 1.2 billion students, 67.7% of the global student population, were affected by school closures as of late May. Districts are now considering reopening schools due to the detrimental effects of closures on the long-term wellbeing of children and the ability of their parents or caregivers to effectively return to work.

School closures come at a big cost

School closures reduce expected student learning gains, which can have lifelong consequences and exacerbate educational and economic inequalities. The amount of learning loss due to physical school closures varies by access to remote learning, the quality of remote instruction, and the degree of student engagement. Low-income students are less likely to have access to high-quality remote learning opportunities. Greater learning loss of Black, Hispanic, and low-income students could increase the existing educational achievement gap in the United States by an estimated 15 to 20%. Beyond learning loss, COVID-19 closures will likely lead to an increase in the rate of high school drop-out. And even for students who stay in school, delaying school reopening until 2021 could lead to reductions in lifetime earnings of 1.6%, 3.3%, and 3.0% for White, Black, and Hispanic students, respectively, over a 40-year working life.

School closures may also result in negative impacts on students' current health safety. For example, a UNICEF report raised awareness that children are at greater risk of abuse, neglect, exploitation, and violence due to lockdown measures.

There is also a concern regarding impacts to physical health. Studies have found that students are increasingly sedentary the longer they are on school break and tend to experience unhealthy weight gain outside of school terms. As physical activity participation and weight status track into adulthood, there are potential lifelong health impacts of closing schools. COVID-19 school closures could increase weight gain due to reductions in access to physical education classes, outdoor spaces for physical activity, and food security for students relying on school meals.

School closures reduce expected student learning gains, which can have lifelong consequences and exacerbate educational and economic inequalities.

In addition to negative impacts on students, school closures prevent parents and caregivers – including potentially 30% of healthcare workers – from fully returning to work. Healthcare workers responsible for infection control in nursing homes, where COVID-19 risk is very high, are among the most highly affected by childcare obligations from school closures. Though school closures are intended to help slow the spread of COVID-19 to reduce the strain on healthcare, they may also serve to reduce the healthcare workforce itself.

Even if school districts decide that the societal benefits of opening schools outweigh the risks, reopening schools will not be easy. And disruption and future school closures may be necessary. There are examples domestically and internationally of schools reopening but then having to close a second time after it appeared that local COVID-19 case counts were rising. However, schools can implement concrete strategies to minimize the risk of COVID-19 outbreaks and to keep students and staff as safe and as educationally productive as possible.

Schools can make us sick, or keep us healthy

The transmission of communicable diseases can occur in school environments. Outbreaks of diseases such as chickenpox, measles, mumps, scabies, acute hemorrhagic conjunctivitis (pink eye), and norovirus in schools have all been well documented in the scientific literature. In some cases, outbreaks have occurred even in populations of school children with high vaccination rates.

There are several reasons why disease outbreaks occur in school environments. Research shows that disease outbreaks can happen when immunization against a disease is not 100% effective, when there is vaccination failure, or when there is an inadequate level of immunity in some of the students. Furthermore, the high degree of interaction of students in schools and the frequency with which children put their hands or objects in their mouths increase the transmission of disease.

Even so, historical disease outbreaks in school environments indicate that implementing adequate intervention strategies can successfully minimize COVID-19 transmission and keep students safe when reopening schools.

Schools should modify their controls based on the level of community spread. We partnered with Harvard's Safra Center for Ethics, Harvard Global Health Institute, and other experts to develop guidance for schools and school districts for making these decisions. This guidance can be found here: https://ethics.harvard.edu/covid-19-response.

GUIDING PRINCIPLES

Follow the precautionary principle

Schools should err on the side of caution when it comes to health and safety. Children generally have less severe COVID-19 symptoms than adults, but they are not immune. Children can become severely ill with COVID-19, and they are capable of transmitting the virus among themselves and to family members or teachers. Older adults are at greater risk of severe COVID-19 illness. On the other hand, schools, teachers, administrators, and parents must also recognize that there is no 'zero risk'. Reopening schools will require accepting that the goal is risk and harm reduction.

Layer defenses

No one control strategy alone can limit the transmission of disease. Schools should approach reopening with a layered defense strategy, where many small interventions and strategies are combined, simultaneously. Schools should deploy an 'all in' approach that uses every control feasible.

Share responsibilities

Just as there is no single control strategy that is effective in and of itself, there is no single entity that is solely responsible for keeping everyone safe. Successfully reopening schools will require continual collaboration between administrators, staff, and teachers and ongoing cooperation among teachers, students, and parents. Everyone has a critical role to play. Getting through this pandemic will require a great deal of social trust.

Limit transmission chains

Even with the best control strategies in place, there will be cases in some schools. To limit classroom outbreaks from becoming school-wide outbreaks, schools should take steps to limit contact chains as much as possible. Within a district, school populations should not be mixed. Within a school, classes should be kept separated as much as possible. Within a classroom, kids should be physically separated as much as possible.

Be flexible

The scientific community's understanding of this virus is changing rapidly. Disease spread and timing are not fully predictable. Schools should recognize that the dynamic nature of knowledge during a global pandemic requires a flexible and adaptive approach. The strategies in this report were developed with careful attention to the most recent scientific discoveries regarding COVID-19 and its effects on and transmission among school-aged children. Our collective understanding of this virus will change, and therefore the approach schools take may change over time, too.

Ensure equity

School closures have disproportionately impacted children of lower socioeconomic status, children with disabilities, and children in other marginalized groups. The reopening of schools must be done with equity in mind. Some challenges to ensuring equity in schools during the current pandemic that should be addressed when developing plans to reopen include:

- Students and staff members may be immunocompromised;
- Students and staff members may face new mental health challenges;
- Students may have to provide childcare for siblings or work to support their families;
- Students may have learning disabilities or need accommodations that are impacted by COVID-19 control measures;
- Students may not have internet access or technology at home;
- Students and staff may have difficulty finding safe transportation to school;
- Students may rely on schools for food security;
- Students may rely on physical activity opportunities during school due to lack of neighborhood safety and/or resources to be active at home;
- Students may not have access to face masks, hand soap, or other supplies that help maintain general hygiene at home; and
- Students and staff members may vary in their understanding of COVID-19 information.

UNDERSTANDING COVID-19

How is COVID-19 transmitted?

COVID-19 is the disease caused by the SARS-CoV-2 coronavirus. Before we talk about specific reopening strategies, it is useful to recall how the COVID-19 virus spreads so we can understand when and how a specific intervention might be effective. There are three routes of transmission for COVID-19 that are supported by models and case studies of outbreaks.

Close-contact transmission can occur via droplets or aerosols (tiny droplets, also called droplet nuclei). Close contact transmission by droplets refers to close-range transmission of virus by sometimes-visible droplets that are coughed or sneezed by an infectious person directly onto the eyes, mouth, or nose of a nearby person. Droplet transmission can be minimized by, among other things, physical distancing and universal non-medical cloth mask-wearing. Close contact transmission by aerosols refers to transmission of virus in tiny, invisible droplets that are generated when an infectious person exhales, speaks, coughs, sneezes, or sings, and that are then inhaled by another nearby person, allowing the virus to deposit directly on the surfaces of their respiratory tract. This close contact aerosol transmission can also be minimized by, among other things, physical distancing and mask-wearing.

Long-range transmission refers to transmission of virus in aerosols, which may be generated when an infectious person exhales, speaks, sneezes, or coughs and then travel out of the immediate 6-foot vicinity of the infectious person via airflow patterns. This airborne virus can remain aloft for more than an hour indoors to infect people who are not interacting closely with the infectious person. Long-range airborne transmission can be minimized by, among other things, increasing outdoor air ventilation to dilute the concentration of airborne virus or filtering air recirculating in a room or building.

Fomite transmission refers to viral transmission via inanimate objects, like desks, tables, playground equipment, or water fountains that are contaminated with the virus. A surface could become contaminated in many ways, for example, after a person coughs directly onto an object or after they sneeze into their hand and then touch the surface. Individuals who touch the fomite while the virus remains viable, and then touch their eyes, nose, or mouth before washing their hands, could be exposed to the virus. How long the virus can be detected on fomites depends on the type of surface and the environmental conditions. Under some conditions, the COVID-19 virus can be detected up to 72 hours after deposition on hard, shiny or plastic surfaces or up to 24 hours after deposition on more porous surfaces, but the risk posed by these day(s)-later detections is much lower than the initial risk because the amount of the detectable infectious virus decreases rapidly over time. Fomite transmission of a virus can be minimized through frequent cleaning and disinfection of commonly-touched objects, through use of automatic or touchless alternatives (e.g., automatic doors), and through frequent hand washing.

What factors determine exposure?

There are three components of exposure – intensity, frequency, and duration. In general, more intense, more frequent, and/or longer duration exposures have the potential to cause more harm. In the case of COVID-19, we can reduce the risk of illness through interventions that reduce any or all of these three characteristics:

Intensity of exposure to SARS-CoV-2 may be minimized by physical distancing because the amount of SARS-CoV-2 in the environment around an infectious person is highest closest to the infectious person. Additionally, infectious people following respiratory etiquette (i.e., cover nose/mouth when coughing or sneezing) and wearing masks reduces exposure intensity to people nearby.

Frequency of exposure to SARS-CoV-2 may be minimized by reducing how often someone is in close contact with individuals outside the home who may be infectious.

Duration of exposure to SARS-CoV-2 may be minimized by spending less overall time inside in close contact with others.

What factors determine risk?

While exposure is largely a function of intensity, frequency, and duration, risk is determined by many additional factors. Most importantly, personal risk is dependent on individual susceptibility. For example, this may be a function of age, gender, pre-existing conditions, or genetics. For these reasons, two people with the same *exposure* may have very different *risk*. Discussions of risk can also be subjective, in that they depend on personal risk tolerance. Last, risk is a function of factors outside of the individual, including the local healthcare capacity, the efficacy of available treatments, and the extent of spread in the underlying community.

Two people with the same *exposure* may have very different *risk*.

What age groups are most susceptible to becoming infected with COVID-19?

Existing research indicates that children are less susceptible to becoming infected with COVID-19 than adults. Studies based on contact tracing data, PCR test results, serum antibody test results, and mathematical modeling from various countries suggest that children are approximately half as likely as adults to become infected with COVID-19 after being in close contact with an infectious person. Younger school-aged children may be less susceptible to infection than teenagers or high school students. Multiple studies of PCR test results among contacts of infected individuals also indicate that older adults are more susceptible to becoming infected with COVID-19 than younger adults.

What are the symptoms and outcomes for kids with COVID-19?

Symptomatic children often experience many of the same symptoms as adults, including fever, cough, and fatigue, along with nasal stuffiness, rhinorrhea, sputum, diarrhea, and headache. Compared to adults, children have more upper respiratory tract involvement (including nasopharyngeal carriage) rather than lower respiratory tract involvement, and prolonged viral shedding in nasal secretions and stool.

Children are much less likely to die from COVID-19 than adults. The infection fatality rate (IFR), the number of deaths per infection, is a useful metric for comparing the severity of COVID-19 infection across groups. Multiple studies confirm that the IFR is much lower among children than adults, while those over 65 years old have a higher risk of death if they contract the virus. In the United States, the Centers for Disease Control and Prevention (CDC) have found no increase excess in deaths in 2020 among those less than 25 years old.

> In general, COVID-19 appears to be less severe among children than among adults.

While severe cases of pediatric COVID-19 are reported to be rare, some groups seem to be at elevated risk of negative outcomes. Children with comorbidities, such as pre-existing cardiac or respiratory conditions, may be at a higher risk for severe COVID-19 requiring hospitalization. Furthermore, a very small fraction of children exposed to the COVID-19 virus may develop a severe hyperinflammatory condition called multisystem inflammatory syndrome in children (MIS-C) which is often accompanied by symptoms of fever, abdominal pain, vomiting, and diarrhea and by extreme inflammation in organs such as the intestine or heart. Finally, it is not yet known whether COVID-19 may have long-term negative health outcomes for children. Severe acute respiratory syndrome (SARS), another respiratory virus, was found to have negative impacts on children's aerobic capacity 15 months after they were ill. Therefore, while children comprise a small fraction of global COVID-19 cases and their symptoms are often mild, the potential for negative health outcomes in children due to transmission in schools cannot be discounted.

How long does it take for symptoms to appear?

The incubation period of a disease is defined as the time from exposure to a disease-causing agent to the time when clinical signs of a disease first appear. This period may vary between individuals and is often reported as a range. For COVID-19, the average incubation period is around seven days in children and five days in adults, but can range to up to 14 days.

When can someone transmit COVID-19?

It is possible for individuals to spread COVID-19 prior to experiencing any symptoms. Studies suggest that transmission of COVID-19 can occur as early as five days before onset of symptoms, though it is most typically limited to the one to three days prior to the onset of symptoms. For mild cases not requiring hospitalization, studies suggest that an individual is no longer able to transmit disease ten days after first experiencing symptoms (as long as they do not have a fever and have improved clinically). Severe COVID-19 cases may have a longer infectious period. According to the World Health Organization (WHO), the infectious period of asymptomatic individuals who have tested positive for COVID-19 can be assumed to have ended on the tenth day after the positive test. The infectious period for symptomatic individuals can be assumed to have ended after ten days have passed since symptom onset and after fever and respiratory symptoms have been resolved for at least three days.

Studies of households indicate that transmission from children to other children or to adults is much less common than transmission from adults to children or transmission between adults.

What do we know about kids spreading COVID-19?

One potential reason for reduced infectivity of children is their reduced susceptibility to infection, which would reduce their overall likelihood of acquiring and transmitting the virus to others.

Children's ability to transmit COVID-19 ("infectivity") is dependent on their susceptibility to infection, development of symptoms, viral load, and their risk factors for exposure and for exposing others. Contact tracing studies indicate that children were not usually the index case (original infected person) in an infection cluster and that children with COVID-19 may be less infectious than adults with COVID-19. Studies of households also indicate that transmission from children to other children or to adults is much less common than transmission from adults to children or transmission between adults. In the limited available data from schools that are meeting in person, transmission between children has also been reported to be low. In fact, reopening schools with COVID-19 risk reduction measures in place in many countries did not lead to increased case counts in those countries.

One potential reason for reduced infectivity of children is their reduced susceptibility to infection, which would reduce their overall likelihood of acquiring and transmitting the virus to others. While asymptomatic or mild cases can certainly spread COVID-19, the generally less severe symptoms in children may also reduce infectivity by not producing as many large droplets or aerosols via talking/coughing/sneezing.

Regardless of children's susceptibility to infection, symptom severity, and viral load, there are unique behavioral factors in this age group that can facilitate the spread of infectious disease, including the large number of contacts of school-aged children and the frequency with which children, particularly young children, put their hands or objects in their mouths. In the absence of further scientific knowledge about COVID-19 transmission among and by children, particularly in school settings, it is reasonable and prudent to assume that COVID-19 transmission may occur between children and from children to adults in reopened US schools.

RISK REDUCTION STRATEGIES

- HEALTHY CLASSROOMS
- HEALTHY BUILDINGS
- HEALTHY POLICIES
- HEALTHY SCHEDULES
- HEALTHY ACTIVITIES

HEALTHY CLASSROOMS

In classrooms, teachers and students can limit the spread of COVID-19 by wearing masks, washing hands, maximizing physical distancing, and maximizing group distancing. These recommendations work together to reduce the risk of exposure by close contact, long-range airborne transmission, and fomites. Each strategy complements the others to mitigate the overall risk of transmission. Schools should consider adopting a plan to incorporate these precautions when reopening and establishing a protocol for how to handle any non-compliance.

Wear masks

- All students, teachers, administrators, and visitors must wear face masks indoors
- Train students and staff on how to wear and care for masks
- Ensure masks meet effectiveness criteria
- Build in short times throughout the day where students and staff don't have to wear masks

As part of a multi-layered strategy that includes physical distancing and other control measures, face masks are an effective way to mitigate transmission from individuals who are infectious, even when they do not have symptoms. When worn properly, masks limit the spread of droplets and smaller aerosols when people breathe, speak, cough, or sneeze. This is called "source control." Masks can also help protect their wearers against COVID-19.

Schools will need to consider a wide range of social, educational, equity, and feasibility factors when deciding on a mask policy. From a safety standpoint, individuals should wear masks as often as possible.

Schools should provide structured training to all students and staff on how to safely choose, wear, care for, clean or discard, and store their masks. For instance, an individual should wash their hands before putting on or removing the mask, only touch the mask by its straps, avoid touching the mask while it is being worn, and change masks if it becomes wet. Individuals should make sure the mask fits snugly to cover the nose bridge, mouth, and chin. Printed guidance, such as infographics from organizations like the WHO and the CDC, should also be posted around the school.

Schools should provide structured training to all students and staff on how to safely choose, wear, care for, clean or discard, and store their masks.

Cloth masks may vary greatly in filtration efficiency and breathability, depending on the fabric and layering. The WHO recommends that masks be at least three layers thick, where the different layers serve to either limit the spread of droplets from the wearer's mouth or protect the mask from outside contamination and penetration. Additionally, more tightly woven materials, such as cotton fabrics with higher thread counts, are preferable, while elastic materials are not recommended due to the higher pore size and lower filtration efficiency.

Wearing a mask all day long, each and every day will be challenging and frustrating. Over time, 'mask fatigue' may set in, and compliance may drop. To limit this, classrooms can incorporate 'mask free' time during the day. For example, consider taking masks off during time spent outside when distancing can be maintained, or during quiet classroom time when there is no talking and students can stay distanced, or have half the class leave the room for activities so the remaining group can distance and take masks off. Choosing lower-risk times for breaks from masks may help ensure masks are worn during higher-risk scenarios. The risks of viral transmission during mask breaks will be lower when other interventions, such as healthy building strategies (like higher ventilation and enhanced filtration) and physical distancing, are in place.

Wash hands frequently

- Wash hands immediately before: leaving home, leaving the classroom, eating, touching shared objects, touching one's face, and leaving school
- Wash hands immediately after: arriving at school, entering classroom, finishing lunch, touching shared objects, using the bathroom, coughing, sneezing, and blowing one's nose, and arriving at home
- Use hand sanitizer containing at least 60% ethanol or 70% isopropanol when washing hands is not possible

> It is recommended that everyone wash their hands before and after touching any high-use items or surfaces.

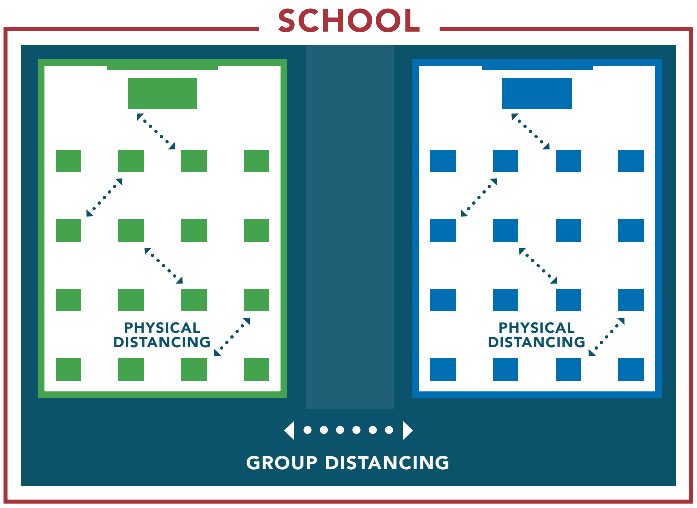
Establish a plan to promote good hygiene practices across the school. Washing hands frequently with soap and water for at least 20 seconds is a simple but effective preventative precaution that addresses fomite transmission and short-range droplet transmission (in the case where infectious droplets land directly on the hand). It is recommended that everyone wash their hands before and after touching any high-use items or surfaces, both to prevent an infectious individual from contaminating a shared surface and to protect others from being infected by a contaminated surface. Everyone should also wash their hands before eating, before touching their face, after using the bathroom, and after coughing, sneezing, or blowing their nose. Handwashing should be incorporated into the school day every time students enter or leave their classrooms and during transitions between activities. Schools could consider setting up handwashing stations with soap and water in classrooms, hallways, or other rooms to help facilitate regular handwashing. If soap and water are unavailable or cannot be frequently accessed without bathroom crowding, hand sanitizer that contains at least 60% ethanol or 70% isopropanol may be used, as it is also effective at inactivating SARS-CoV-2.

Maximize physical distancing to protect individuals

- Aim for six feet between individuals, as much as possible, for as long as possible; if everyone is masked in the classroom, maintaining three-foot distancing is acceptable
- Repurpose other large, unused spaces in the school as temporary classrooms (e.g., auditorium)
- Move class outdoors if possible
- Replace hugs, handshakes, and high-fives with smiles, waves, and thumbs-ups

Physical distancing lowers the probability that a person either infects someone else or becomes infected by someone else. It limits COVID-19 transmission by reducing the intensity of someone's exposure to any infectious droplets or aerosols. Physical distancing within schools could be encouraged by moving desks as far away as possible from each other, turning desks to all face the same direction, and assigning seats. Schools should maximize physical distancing and aim for six feet of distance between people. However, due to the high risks associated with school closures and data showing that three-foot distancing can be effective when masks are worn and community spread is low, six-foot distancing should not be used as a bright line cutoff. Three feet is acceptable in the classroom for times that generate lower levels of emissions (e.g. normal talking). This recommendation factors in the lower risk of kids contracting COVID-19 (especially young kids), their lower risk of severe outcomes, and evidence that suggests lower risk of transmitting the virus. Six feet should remain the minimum for activities like loud talking and singing, and for all adult to adult interactions due to adults being more likely to transmit the virus, and more likely to suffer severe outcomes if they contract the virus. Teachers and administrators should continue to maximize their distance from students as much as possible, for as long as possible. Transient interactions of less than three feet, such as passing in the hallway or handing in papers to the teacher, are unavoidable and lower risk due to short duration and universal masking.

To facilitate physical distancing, large outdoor spaces, gymnasiums, cafeterias, and auditoriums could be repurposed as temporary classrooms to improve physical distancing practices for larger class sizes. If using an outdoor space, remember to consider potential effects of weather and temperature. School districts may also consider moving some classes from crowded schools to schools that have extra space to promote physical distancing. Last, create a culture where acts of social solidarity that require physical contact, like hugs, handshakes, and high-fives, are replaced with new contactless signals, like smiles, waves, and giving a thumbs-up.



Maximize group distancing to slow transmission chains

- Keep class groups as distinct and separate as possible
- Limit students moving between different classrooms
- Avoid large groups and gatherings, both in and out of school

Whereas physical distancing focuses on preventing infection transmission between classmates in the same room, group distancing aims to reduce the risk of an infection leading to a widespread outbreak in the school. For example, group distancing means that students in one class are kept separate from students in other classes, so these class groups avoid being in the same location (e.g., classroom, cafeteria, playground) at any given time. School-wide gatherings, such as assemblies in the auditorium and school field trips, should be avoided to maintain group distancing.

The strategy of keeping classes separate as much as possible may be more practical for younger students who stay within one class group rather than older grades where class groups often change. In older grades, consider making cohorts of students who take the same core courses and having elective courses be remote so that group distancing can be maintained. This may require schools to adjust class scheduling and be more prescriptive about curriculum tracks that older students can sign up for. Another strategy for specialized teachers is to have them rotate between classrooms instead of having students move between classrooms. This reduces the number of students using a particular desk, the frequency with which students touch common surfaces like door handles, the frequency of close contact interactions in hallways, and the potential exposure to aerosols in classroom air from a sick individual in the previous class.

If there is limited space for a class to practice physical distancing, students within the class could be further organized into smaller pods that stay together throughout the day, including sitting together in class and at lunch and playing together during recess. These pods within larger class groups should still be physically spread out from each other as much as possible. Other countries have found this practice helpful particularly with elementary school students for whom peer socialization is a significant part of school and complete physical distancing might be difficult to enforce.

Group distancing means that students in one class are kept separate from students in other classes, so these class groups avoid being in the same location at any given time.

Limit sharing of objects

- Choose lesson plans that limit student contact
- Provide students with their own separate supplies when possible
- Provide disposable disinfectant wipes for individuals to use before using shared objects

Frequent hand-washing, including before and after using shared materials, is the most important control strategy that should be reinforced when objects and materials will be shared.

In a school setting, it will be difficult to limit sharing objects, like books, pencils, electronics, and art supplies. Schools can provide an adequate supply of disinfectant wipes in classrooms and throughout the school so individuals can disinfect objects before use. However, frequent hand-washing, including before and after using shared materials, is the most important control strategy that should be reinforced when objects and materials will be shared. In addition, teachers can try to select lessons and activities that do not require shared equipment or close contact. When possible, provide each student their own supplies (e.g., art supplies) that they will use for all activities. If each classroom has limited supplies, consider pooling resources and then rotating supplies between different classrooms on different days, while ensuring adherence to cleaning and disinfection policies.

HEALTHY BUILDINGS

Healthy building strategies that improve air quality and clean surfaces should be incorporated as part of a layered defense against COVID-19. For improving indoor air quality in the classroom, we recommend prioritizing control strategies — ventilation, filtration, supplemental air cleaning — and targeting a combined 4-6 air changes per hour (ACH) for classrooms through any combination of these approaches. Other spaces in schools such as gyms, auditoriums, kitchens, and nurses' offices may require different targets for the combined clean air change rates.

ACH can be calculated by adding the total amount of "clean" air entering the room and dividing it by the room volume. The "clean" air in a classroom can be calculated as the sum of the ACH from ventilation (e.g. outdoor air supplied by a mechanical system or open windows), from filtration of recirculated air by a mechanical heating, ventilation, and air conditioning (HVAC) system (accounting for the efficiency level of the filters in the system), and from air cleaning provided by a portable air cleaner with a HEPA filter.

(dark green)	Ideal (6 ACH)
(light green)	Excellent (5-6 ACH)
(yellow)	Good (4-5 ACH)
(pink)	Bare minimum (3-4 ACH)
(red)	Low (<3 ACH)

$$\text{Air changes per hour} = \frac{\text{"clean" air rate}}{\text{room volume}} = \frac{\text{cubic feet per minute} * 60 \text{ minutes}}{\text{length} * \text{width} * \text{height (in feet)}}$$

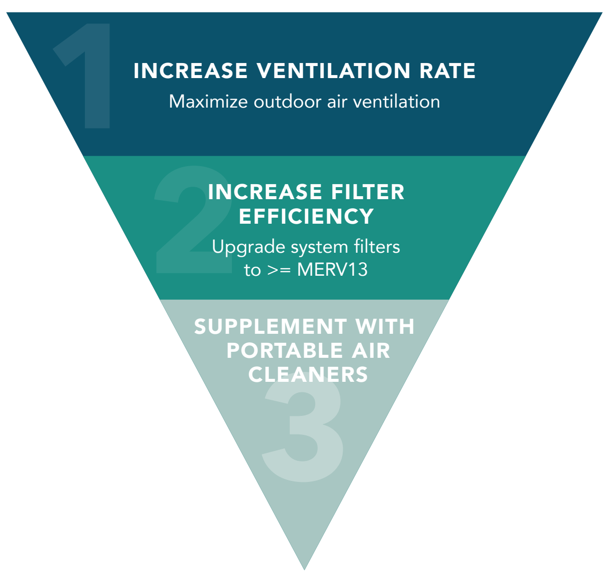
Additional information on how to assess ventilation in classrooms and calculate the total, combined ACH in a classroom can be found in this 5-step guide to checking ventilation rates in classrooms: https://schools.forhealth.org/ventilation-guide

A simple tool for helping select an appropriate portable air cleaner for a classroom and for understanding the air change per hour calculation can be found here: https://tinyurl.com/portableaircleanertool

For more technical information on portable air cleaners and how to select portable air cleaners, please read our white paper, "Portable Air Cleaners: Selection and Application Considerations for COVID-19 Risk Reduction": https://schools.forhealth.org/wp-content/uploads/sites/19/2020/08/Harvard-Healthy-Buildings-Program-Portable-Air-Cleaners.pdf

System performance should be verified regularly. For more detailed and technical guidance, we recommend reviewing the materials produced by the ASHRAE Epidemic Task Force. Schools should work with facilities managers and outside professionals to tailor these recommendations for their unique building systems.

Prioritization of Engineering Controls to Reduce Long-Range Airborne Transmission



Increase outdoor air ventilation

- Bring in more fresh outdoor air

SARS-CoV-2 present in the coughs, sneezes, and exhaled breath of an infectious person can be transported in the air to disperse throughout a room and can remain aloft for hours. This long-range airborne virus can infect even people who haven't had close contact with the infectious person if they inhale a sufficient amount of virus. Bringing fresh outdoor air into a room can dilute and/or displace any present airborne virus, which thus reduces the probability that someone breathes enough infectious aerosol to become infected. As an ideal, holding class outdoors provides the freshest air and most effective dilution of any infectious airborne SARS-CoV-2.

As the next best solution, mechanical ventilation systems in buildings can forcibly bring outdoor air inside and then distribute that fresh air to different areas of the building. In some HVAC systems, some fraction of the indoor air is recirculated and mixed with the outdoor air coming in to save on cooling and heating energy costs. However, during a pandemic, when long-range airborne viral transmission can occur, air recirculation can lead to a buildup of airborne viral particles indoors and also potentially spread the virus to other areas of the building. Therefore, buildings with HVAC systems that mix the fresh outdoor air with recirculated air should maximize fresh outdoor air to the extent possible during this period. These types of buildings should also install MERV 13 air filters or higher in their HVAC systems (see next section for details). In addition, buildings should not shut off or reduce their mechanical ventilation during before-school or after-school hours when there still may be people in the building, including students, staff, and custodians during any student programs, cleaning times, teacher class preparation, sports (e.g., if students are returning to lockers), or other activities. Finally, mechanically ventilated schools should evaluate any potential contaminant source near the outdoor air intake duct. For example, the outdoor air inlet should not be located too close to the exhaust air outlet or contaminated indoor air that is exhausted out of the building could re-enter (refer to local building codes on minimum required distance, generally 10 feet).

Buildings should maximize fresh outdoor air to the extent possible during this period.

> Devices that simply recirculate the same indoor air without filtering it or replacing it with fresh air are not helpful in reducing any airborne virus present in the room.

Schools that do not have mechanical ventilation systems can increase the amount of natural ventilation via a) open windows, doors, or skylight, b) roof ventilators, c) stacks, and d) specially designed inlet or outlet openings. Opening windows can help bring in fresh outdoor air and dilute and exhaust contaminants in the indoor air. Natural ventilation through windows can be effective but is dependent on factors that drive pressure differentials between outdoors and indoors, like wind pressure and stack (or buoyancy) effects. Therefore, airflow into the building, even with open windows, is not guaranteed. To help address this, schools can consider using window fans or box fans positioned in open windows to blow fresh outdoor air into the classroom via one window and indoor air out of the classroom via another window. Note that devices that simply recirculate the same indoor air without filtering it or replacing it with fresh air are not helpful in reducing any airborne virus present in the room (including most window air conditioning units, fans used in rooms with closed windows, and fan coils and radiators).

In some cases, it is not reasonable to bring in additional outdoor air. For example, on very hot summer days or very cold winter days it may not be possible to maintain a comfortable temperature in the classroom if the windows are open. Mechanical ventilation systems, similarly, may need to recirculate more indoor air and bring in less fresh outdoor air when extremely hot or cold outdoor air cannot be sufficiently cooled or heated before it is blown into classrooms. Other factors may also impact the ability to increase outdoor air ventilation, particularly for naturally ventilated buildings, including but not limited to, security concerns, high outdoor air pollution or pollen levels, or high outdoor noise levels. The highest tolerable amount of outdoor air ventilation should still be used, even if students, teachers, and administrators have to adjust their clothing to be comfortable (e.g., wear a jacket indoors in the winter). In cases where the outdoor air ventilation rate cannot be increased, the minimum ventilation rates specified by ASHRAE 62.1 should be met while other strategies such as enhanced filtration and air cleaning are used to achieve a combined 4-6 ACH from ventilation and filtration. In the future, schools may consider indirect energy exchangers such as heat recovery ventilators (HRV), energy recovery ventilators (ERV), and desiccant systems to retrieve energy from the conditioned return air but avoid mixing the air.

Filter indoor air

- Increase the level of the air filter to MERV 13 or higher on recirculated air
- Inspect filters to make sure they are installed and fit correctly
- Check that sufficient airflow can be maintained across the filter
- Maintain and change filters based on manufacturer's recommendation

Filtration in school buildings can help mitigate long-range airborne viral transmission by removing SARS-CoV-2 from air that is mechanically recirculated through the building. In buildings with mechanical ventilation systems, existing filters can be upgraded to filters with efficiency ratings of at least MERV 13 or the highest MERV rating the system can handle based on the pressure drop and system capacities (e.g., fan power). MERV ratings, developed by ASHRAE, indicate the percentage of particles and the sizes of particles that filters can remove from air passing through them. Filters with higher MERV ratings remove higher percentages of particles and more effectively remove small particles than filters with lower MERV ratings. Filters with MERV ratings of 13 or higher are recommended for SARS-CoV-2 by ASHRAE. Filters need to be periodically replaced and inspected to make sure they are sealed and fitted properly, with no gaps or air bypass. In some cases, if the airflow distribution system is not designed to handle a higher MERV filter, air could leak around the filter edges, compromising any benefit that might have even been gained from a lower MERV filter.

Supplement with portable air cleaners

- Supplement ventilation and filtration with air cleaning devices
- Select portable air cleaners with HEPA filters
- Size devices carefully based on the size of the room

Portable air cleaners with high-efficiency particulate air (HEPA) filters may be useful to reduce exposures to airborne droplets and aerosols emitted from infectious individuals in buildings. Portable air cleaners are typically most effective in smaller spaces, and care must be taken when choosing a device to ensure it is the correct size for the room where it will be used. One metric to consider is the clean air delivery rate (CADR). The CADR reflects both the amount of air that a unit can process per unit time and the particle removal efficiency of the filter. A helpful rule of thumb is that for every 250 square feet of space, a CADR of about 100 cubic feet per minute (cfm) is desirable. CADR is not the only factor to consider. Portable air cleaners vary in their ability to circulate air in the room, so not all devices with the same CADR rating are equivalent. Devices that provide better mixing of the indoor air can capture particles from more of the room's airspace and are therefore preferred. Because potential viral sources could be in various locations within a room, it may be beneficial to have several units that meet the target CADR values rather than a single larger unit. For example, if a room needs 300 cfm provided by air cleaning, placing two portable air cleaners with CADRs of 150 cfm or three portable air cleaners with CADRs of 100 cfm, in different locations of the room, may be more effective than using just one portable air cleaner with CADR of 300 cfm. In larger spaces, industrial-sized supplemental ventilation and filtration units are available and should be considered. Furthermore, room airflow patterns and the distribution of people in the room should be considered when deciding on air cleaner placement that maximizes source control and prevents airflow from crossing people. Since air cleaners should be operated while people are present, it may be important to compare different models to find one that does not generate disruptive noise. Reviewing the decibel or sound ratings, which are available for some devices, and selecting a lower value can help identify a quieter option.

Verify ventilation and filtration performance

- Verify through commissioning and testing
- Work with an expert to evaluate building systems, ventilation, filtration, and air cleaning
- Measure carbon dioxide (CO_2) as a proxy for ventilation

Mechanical HVAC systems in buildings tend to get out of tune. Within several years of construction, ventilation airflows may change from how they were designed. Schools can ensure that there is adequate ventilation and filtration through a process of commissioning and testing. Commissioning is the process of checking HVAC performance to ensure that systems are operating as designed. Commissioning and testing should be performed by trained individuals and should be performed throughout the school year.

In between commissioning events, there are several ways to test whether a classroom's ventilation delivers sufficient outdoor air. In addition to working with trained experts, a school could quickly evaluate ventilation performance using carbon dioxide (CO_2) as a proxy for ventilation using low-cost indoor air quality monitors. In an unoccupied classroom, background CO_2 would be approximately equal to the concentration of CO_2 in the atmosphere: 410 ppm. When students and teachers are present in a classroom, they exhale CO_2 into classroom air at a relatively constant rate causing CO_2 to rise above the background concentration. At some point, the concentration of CO_2 reaches an equilibrium based on the amount generated indoors, and the amount diluted by ventilation. This is called 'steady-state' and can be used as a quick indicator of ventilation performance. Lower CO_2 concentrations while students are present suggest that outdoor air ventilation rates are acceptable; higher CO_2 concentrations suggest other strategies are needed. Instructions for using a low-cost CO_2 monitor to estimate classroom outdoor air ventilation rates can be found in this 5-step guide to checking ventilation rates in classrooms: https://schools.forhealth.org/ventilation-guide

It is important to note that while CO_2 measurements are a good indicator of overall ventilation, they will not indicate whether other air cleaning interventions are effective. For example, if a classroom is operating portable air cleaners to remove the virus from air, viruses and other pollutants will be removed even if CO_2 remains high because cleaners with HEPA filters are not designed to remove CO_2.

Lower CO_2 concentrations while students are present suggest that outdoor air ventilation rates are acceptable; higher CO_2 concentrations suggest other strategies are needed.

Consider advanced air quality techniques

- Attempt to maintain indoor relative humidity between 40-60%
- Consider advanced air cleaning with ultraviolet germicidal irradiation (UVGI)

Additional air quality controls can be considered, including maintaining higher humidity and air cleaning with ultraviolet germicidal irradiation (UVGI). Because these controls require great care in implementation, they are listed in this separate section as advanced considerations. Schools that consider these approaches should consult with outside technical experts.

People's physiological defenses against respiratory viral infection function best in mid-range humidity levels. Humidity also impacts environmental quality: dry environments are associated with higher incidence of some viral infections, such as influenza, but too much humidity can increase the presence of mites and lead to mold growth. ASHRAE suggests that maintaining relative humidity between 40% and 60% may help reduce COVID-19 infection rates. Note that most buildings cannot easily adjust humidity with existing systems, and that ventilation and filtration should be prioritized. For more information on indoor relative humidity and temperature combination setpoints within this relative humidity range that are aimed at providing a healthy as well as a comfortable environment for occupants, for winter and summer operation, refer to the ASHRAE's Pandemic Task Force's reopening plan for schools and universities.

UVGI is an air cleaning technology that is sometimes used in buildings. UVGI uses low-wavelength ultraviolet light (UVC light) to destroy viruses. UVGI has been shown to be effective in disinfecting surfaces and air from bacteria and viruses such as influenza. In buildings, this technology is usually deployed as upper room UVGI to destroy airborne virus in the upper airspace of a room or as UVGI in supply air ducts to destroy airborne virus present in recirculated air. UVGI may be able to reduce exposures to airborne COVID-19. In order for UVGI to be effective, there must be sufficient contact time between the virus and the UV light; this often presents a challenge for installing an effective in-duct UVGI system. Similarly, upper room UVGI works best when the air in a room is well mixed so that airborne virus emitted by people in the lower portion of the room is lofted into the upper airspaces where it can be treated. Other potential issues with UVGI in schools include cost, maintenance, and potential health concerns of inadvertent UV exposures. In general, UVGI should be further discussed with an expert before consideration for use in a school.

Use plexiglass as physical barrier

- Install plexiglass shielding in select areas with fixed interactions (e.g., reception desk, cafeteria checkout)
- Check the air mixing and interzonal air flows in indoor environments to ensure the plexiglass does not alter ventilation in some areas

Schools that cannot adequately ensure physical distancing might consider installing physical barriers (e.g., plexiglass separators) in select areas. Plexiglass is a clear, solid material that acts to block transmission of large droplets between two people in close contact. Consider installing plexiglass shielding in areas where there is fixed and steady interaction, like the reception desk and cafeteria checkout. Within classrooms, plexiglass shielding may be useful for physically separating students who share tables, and as an additional barrier between the teacher and student areas of the classroom. Installing plexiglass barriers may create areas within a room with uneven mixing of the air. This can inadvertently increase the concentration of airborne SARS-CoV-2 in localized areas. Schools should consider asking experts to check air mixing and interzonal airflows in indoor environments after installing plexiglass barriers to ensure no disruption of ventilation and airflow.

Install no-contact infrastructure

- Adjust existing infrastructure to make it touchless
- Install touchless technology for dispensers of hand soap, hand sanitizer, and paper towels

To limit fomite transmission, existing infrastructure could be replaced with contactless alternatives. For example, doors with handles could be replaced with automatic doors. If installing new infrastructure is not feasible, alternative policies could be implemented (e.g., doors could be propped open, so students do not need to touch them).

In addition to infrastructure, technology in bathrooms, classrooms, cafeterias, and other locations should be made as touchless as possible. This includes automatic dispensers of hand soap, hand sanitizer, and paper towels. Contactless hand sanitizer dispensers at the entrance inside classrooms could improve hygiene of students during transitions between activities and after touching shared objects or surfaces within classrooms. Additionally, foot pedals could be installed to replace buttons on water fountains.

Keep surfaces clean

- Frequently clean and disinfect surfaces following directions on product labels
- Provide adequate training and properly-sized personal protective equipment to protect custodial staff

Shared equipment, spaces, materials, and surfaces should be cleaned and disinfected throughout the school day. Special attention could be paid to the most highly touched surfaces, such as door handles, light switches, sink handles, and any elevator buttons. In addition to cleaning by janitorial or custodial staff, provide teachers and classroom staff with disinfectant wipes to disinfect items in their classrooms between uses. The infectious virus does become inactivated over time without cleaning, but this would not be acceptable for objects regularly reused or frequently touched surfaces. The EPA has compiled a list of safe and recommended disinfectant products for use against COVID-19.

Remember, frequent hand-washing is the best defense against transmission from contaminated surfaces.

In addition, schools should ensure custodial and janitorial staff have sufficient personal protective equipment to safely clean contaminated areas, including any necessary facemasks, gloves, goggles, and gowns. They should also be trained in proper disinfection protocols and safety practices during cleaning (e.g., washing hands afterward, discarding disposable equipment, opening windows/doors to increase fresh air when possible, staying home when sick), and in best disinfection practices to prevent fomite transmission of COVID-19.

Focus on bathroom hygiene

- Keep bathroom doors and windows closed and run any exhaust fans at all times
- Install lids on all toilet seats, if possible, and keep the lids closed during flushing
- Stagger bathroom use

SARS-CoV-2 has been found on toilets and in stool of COVID-19 hospital patients, indicating that bathrooms may be places where elevated fomite and long-range airborne transmission could occur through touching shared surfaces and breathing bioaerosols generated by toilet flushing.

Fomite transmission risk in bathrooms may be minimized by handwashing and installing touchless faucets, soap dispensers, towel dispensers, and doors. In some cases, it may be appropriate for an adult to be present to assist with or monitor handwashing in the bathroom, particularly for small children. It may also be prudent to have children wash their hands with soap and water or use hand sanitizer after they return to their classroom in a location where their teacher can monitor hand hygiene.

Fomite transmission risk in bathrooms may be minimized by handwashing and installing touchless faucets, soap dispensers, towel dispensers, and doors.

In order to prevent the spread of contaminants from bathrooms to other indoor spaces, negative pressure differentials with respect to other building zones should be maintained by running bathroom exhaust fans continuously, and keeping bathroom doors and windows closed at all times, even when not in use. Long-range airborne transmission risk in bathrooms may be further minimized by installing toilet lids, keeping lids closed when not in use, and encouraging students to close the lids before flushing.

Before re-occupying the school building after closures, schools should flush all bathroom faucets, drains, and toilets in case the water in the p-traps has evaporated. In addition, any time there is a sewer gas smell, schools should make sure to fix the plumbing.

Finally, bathrooms can be places where crowding occurs, especially when children have shared windows of time when they can use the bathroom. To enforce physical and group distancing and to minimize crowding, it may be useful to close bathrooms during transition periods and promote bathroom breaks during class time instead, to assign classrooms to use specific bathrooms or to stagger the timing of scheduled bathroom breaks by class.

HEALTHY POLICIES

How a school operates significantly impacts the safety of its students, teachers, and staff. This section outlines potential school policies to monitor and respond to potential COVID-19 cases and thus support the health of the entire school community.

Establish and reinforce a culture of health, safety, and shared responsibility

- Provide training to teachers, staff, students, and parents/guardians
- Start each day with a morning message to the entire school reinforcing health messaging
- Create and display signs around the school as reminders of rules, roles, and responsibilities
- Hold weekly and monthly all-staff meetings on COVID-19 to evaluate control strategies
- Send out weekly reports and reminders to parents and students of their respective roles
- Reward good behavior
- Encourage behaviors that reduce the risk of contracting COVID-19 outside of school hours

Public health interventions only work when there is training and reinforcement. Schools can begin training staff, teachers, and students in the weeks leading up to the beginning of school. This can include virtual training and education sessions focused on the basics of disease transmission, new policies and procedures, and expectations regarding code of conduct. General training sessions should be supplemented with training targeted toward specific people (administrators, facilities, teachers, students, staff). A strong communications plan should be developed with daily and weekly 'all school' communications via email. Big, bold, and fun signs should be placed throughout the school to reinforce the culture of health messaging. For example, hand washing instructions could be posted in all bathrooms, physical distancing plans, and proper face mask techniques could be posted in hallways, and a COVID-19 symptom chart and contact plan could be available in the nurse's office. Administrators and teachers should begin each day with a safety message.

Public health interventions only work when there is training and reinforcement.

The ability to continue having in-person classes is dependent on shared responsibility between administrators, staff, teachers, students, and and parents/guardians. This extends to activities outside of the school and outside of school hours.

When an individual engages in behavior that puts them at a higher risk of contracting COVID-19, regardless of where that activity occurs, it puts the community at a higher risk for contracting COVID-19. Everyone must be mindful that actions in the evening, on weekends and on holidays can affect the school community.

Members of the wider school community should keep social circles very small, avoid indoor gatherings, wear masks at all times when with those outside of the immediate household, limit interactions with people in other regions, avoid higher risk locations like bars and restaurants, avoid long-distance travel and areas with a high number of COVID-19 cases. If traveling is necessary, quarantining for 14 days before returning to school is recommended.

Flu shots are one specific example of an activity that makes the community safer. All members of the school community should receive a flu shot if possible. Flu shots will help keep the community healthier through winter months and will help reduce the burden flu patients place on hospital or medical resources.

Form a COVID-19 response team and plan

- Have a person or team in charge of implementing and disseminating COVID-19 policies
- Implement contact tracing to notify class groups if they may have been exposed
- Ensure staff are aware of privacy policies regarding disclosure of COVID-19 status
- Increase staff surge capacity if possible by recruiting student teachers, substitute teachers, community volunteers, and/or recent retirees

Schools should have a dynamic COVID-19 plan document that they can share with students, parents/guardians, teachers, staff, and anyone else using the facilities (e.g., for election voting). As situations evolve rapidly, it may be useful to designate a person or team to act as the liaison between school administrators, teachers, students, families, and local boards of health. This team should disseminate information about new policies and programs as soon as it becomes available, including information about anything children need to carry with them (e.g., face masks) and any changes to the timing or location of classes.

Schools could consider ways to cross-train and/or recruit additional teachers and staff to form a reserve of employees that can be utilized dynamically.

The COVID-19 response team may also be responsible for gathering symptom reports and sending contact tracing notifications in collaboration with local health departments. When someone in a class is sick, contract tracing is very important to prevent a school outbreak. While Family Educational Rights and Privacy Act (FERPA) policies must be strictly adhered to, those who have been in contact with a suspected or confirmed COVID-19 case should be notified as soon as possible so they can follow quarantine procedures. Students or staff sharing classroom space with a case are assumed to be contacts, but schools may find it useful to also encourage parents and/or guardians to log additional interactions (e.g., playdates or after school activities) so they can be contacted quickly.

Additional staff members may be needed for the COVID-19 response team or due to reduced class sizes, increased requirements for supervision (e.g., during recess), and an increased number of sick days. Schools could consider ways to cross-train and/or recruit additional teachers and staff to form a reserve of employees that can be utilized dynamically. Schools may be able to increase recruiting pools by reaching out to student teachers, substitute teachers, community volunteers, and recent retirees. Care should be taken to ensure these staff are trained in school COVID-19 policies and can either work remotely or adequately maintain physical distancing at school.

Prioritize staying home when sick

- Ask students and school staff to stay home when not feeling well
- Request daily self-declaration that people heading into school are free of symptoms
- Identify a comfortable room where individuals who become ill can isolate for the rest of the school day

Schools should ask individuals to stay home when sick. Sick individuals staying home should face no negative consequences or unfair attendance records, and there should be a plan in place to ensure continuity in remote learning or work for sick individuals who cannot come to school in-person.

Students, school staff, and parents should be made aware of the symptoms of COVID-19. Schools should consider a daily declaration, via electronic means, that each person heading to school that day is free of symptoms. Additionally, a system should be in place for any of them to privately report symptoms, so this information can be used to make decisions about cleaning, notification of potential contacts, and/or classroom or school closures. Schools may also opt to directly screen students before school (e.g., using temperature checks and visible symptom inspections), following guidance of the CDC or other relevant organization, to ensure that students who are sick remain at home. In addition, teachers should be vigilant about the health of the students in their class and notify the school nurse or a designated administrator immediately if a child is coughing or seems to have a fever in class.

Sick individuals staying home should face no negative consequences or unfair attendance records, and there should be a plan in place to ensure continuity in remote learning or work.

If a student is found to exhibit new symptoms of illness while at school and it is not possible for them to go home immediately, the sick student could be asked to isolate in a dedicated room(s) in the school, such as the nurse's office. There should be a predetermined protocol for how to clean and disinfect any room the sick individual may have contaminated (including the isolation room). Ventilation and filtration in these isolation rooms needs to be verified. Ideally, contaminated rooms should be left empty for up to 24 hours or as long as possible before having staff clean or before allowing the room to be reoccupied. Care should be taken so as not to unnecessarily disclose student health status to other teachers or students in accordance with the Family Educational Rights and Privacy Act and Americans with Disabilities Act policies

Promote viral testing

- Encourage viral testing any time someone has symptoms, even if mild
- Track testing improvements and incorporate widescale frequent testing of the general school population into future plans
- Provide information on where people can go for testing

Diagnostic viral testing for those with symptoms or who have come in contact with someone who has COVID-19 is a critical strategy for slowing the spread of the virus and preventing major outbreaks in schools because it can help identify those with active infections who then need to self-isolate. Schools should identify locations where students, staff, and families can be tested nearby and provide that information to everyone ahead of time. As testing capacity, speed, and accuracy improves, schools should consider more frequent testing as an approach to identify pre-symptomatic individuals.

Establish plans for when there is a case

- Develop a plan for what to do when a case is identified in the school
- Establish a timetable for when someone with COVID-19, and their close contacts, can return to school
- Regularly check CDC guidance for updates to their protocols and definitions

The transition to remote learning presents a massive disruption to learning, and, depending on the nature of the case and controls that are in place, schools should coordinate with local boards of health to determine if school closure is absolutely necessary in each instance. In addition, close contacts (defined in CDC guidance) of the infected individual should stay at home for 14 days after their last interaction with that person.

Identifying close contacts will be simplest in the case of distinct class groups that take all the same classes together; then, when an individual from the class group becomes sick, the whole class can stay home and move to remote education for 14 days after the exposure. Having the entire exposed class group stay home and transition to remote learning would also help maintain privacy for the sick individual and ensure equal educational access within the class. Isolating exposed class groups will help prevent outbreaks from occurring in the whole school. Finally, there should be a policy on when a school should entirely shut down in favor of remote education if COVID-19 appears to be spreading through the school.

Schools may find it useful to follow CDC guidance when developing a school policy on when sick individuals can return to school in person. For example, if a student or staff member was suspected or confirmed to have COVID-19, they could be asked to stay at home (with remote learning or work options) until they meet the criteria for return to school, as defined by school leadership in accordance with local or CDC guidance.

Support remote learning options

- Provide necessary supplies and support systems to continue remote education for students staying home
- Train staff on how to best facilitate remote learning
- Consider district-wide remote learning by grade, staffed by recent retirees or teachers with pre-existing conditions

There are a number of reasons that some students may need to continue remote learning as schools reopen. Students who are sick or who have family members who are sick with COVID-19 should remain at home for two weeks. Students who are immunocompromised, or have family members who are, may feel safer remaining at home. Students with behavioral or medical circumstances who may find it difficult to adjust to new policies such as no physical contact, required facemasks, or frequent handwashing may benefit from remaining at home. Older children may have to remain at home to provide childcare for younger siblings who are not in school full-time as parents return to work.

Regardless of the reason a student is learning from home, it is vital that they are provided with access to the Internet, necessary technology such as a tablet or computer, and support systems often found in schools such as guidance counselors and meals. Flexibility may be required, as some students may not have equal access to support, time, or resources to complete schoolwork at home. Schools will need to provide staff training on learning platforms that allow for equity and access to learning and that conform with students' individualized education plans and medical needs. School districts can consider creating district-wide remote learning teams for each grade level, staffed by calling up recent retirees or current teachers with pre-existing conditions so classroom teachers can focus on in-classroom learning.

De-densify school buildings

- Limit parent and visitor access
- Move parent-teacher conferences online
- Promote work-from-home for administrative duties, where possible
- Hold staff meetings via videoconferencing as much as possible

Minimizing the number of visitors in the building can help reduce the density of occupied spaces. If parents or guests need to enter the school building, they could be required to gain approval first, be briefed on school COVID-19 policies, and verify they do not have symptoms. Schools can also consider restricting visitor access to limited times when classes are in session (i.e., at times when there will not be many people in the hallways). Furthermore, any parent-teacher conferences or other planned meetings with visitors could be held online instead of at the school.

In addition, to facilitate physical and group distancing within schools and reduce everyone's risk of exposure, schools may consider classifying non-essential staff that can work remotely. Any necessary faculty or staff meetings could be held remotely through videoconferencing if possible.

Protect high-risk students and staff

- Advocate for high-risk students and staff to have access to effective remote learning or work
- Re-assign roles if needed to allow staff members to work while staying safe
- Take extra precautions if high-risk students or staff come to school

Students, staff, or their family members who have pre-existing conditions making them at higher risk for a more severe case of COVID-19 may require additional considerations in order to keep them safe. It will be critical to communicate with these students, families, and staff to come up with a strategy that works best for them. In many cases, this may result in at least some degree of remote learning or teaching. In addition to the remote learning considerations above, it is important to consider the mechanisms that can allow students studying remotely to remain engaged with their teachers and classmates that are in the classroom as much as possible.

Some high-risk students who require additional safety measures may not have the same access to resources or a safe family environment for remote learning.

Some high-risk students who require additional safety measures may not have the same access to resources or a safe family environment for remote learning. In these scenarios, consider repurposing rooms within the school building as a computer lab, where high-risk students can safely complete their remote work with facilitation of a staff member. These rooms should follow all of the same protocols as classrooms and be reserved only for students who need to use them and are high-risk.

Similarly, consider allowing high-risk teachers who do not wish to work from home to work from a designated room in the school building. They may, for example, be assigned a new role (e.g., on the COVID-19 response team) or contribute to lesson planning or teaching remotely.

HEALTHY SCHEDULES

Throughout the school day, there are opportunities to reduce transmission risk. As a starting point, schools may choose to implement an attendance policy that reduces the number of students in the school at a given time. While students are in school, transition times can be limited and lunch can be modified to maintain physical and group distancing. Schools may also be able to facilitate lower-risk transportation to and from school.

Manage transition times and locations

- Stagger school arrival and departure times, class transitions, and locker access
- Set up separate entrances and exits for different groups of students when possible
- Use well-marked lines on the floor to encourage physical distancing and indicate direction of travel

School arrival, departure, and class transitions can be a high-risk time due to the potentially large number of people in close contact in school entrances, exits, and hallways. Schools may consider staggering arrival and departure times so that children in different classes are not all entering or exiting the building at the same time. Even a difference of 5-10 minutes for each class or grade level could greatly reduce the number of students in the hallway heading to the door for dismissal at one time. Students and staff should be encouraged to not loiter in entrances, exit areas, or hallways, but if waiting is necessary, lines should be clearly marked to maintain physical distancing. In small hallways or stairwells, clearly marked paths on the floor that indicate one direction of travel could be used when possible. Additionally, different doors could be used by different classes or grades to enter and exit the school to minimize crowding and to reduce the number of people touching the same doors. Other recommendations about ways to reduce the number of transition times, such as by rotating teachers (instead of students) and serving lunch in the classroom, are found in other sections of this report.

Even a difference of 5-10 minutes for each class or grade level could greatly reduce the number of students in the hallway heading to the door for dismissal at one time.

Make lunchtime safer

- Use student classrooms or other school locations as temporary lunchrooms to facilitate group distancing
- Stagger lunch times in shared lunchrooms and clean and disinfect surfaces between groups
- Maintain physical distance between individuals eating lunch together
- Package school-provided meals in single-serving containers instead of serving food buffet-style
- Reinforce 'no sharing' of food, utensils, drinks
- Enhance engineering controls for times when masks are not worn

> To limit the number of contacts of students and staff and maintain group distancing, schools may serve lunch in classrooms at students' desks or in alternative lunchrooms (e.g., repurposing the gymnasium or auditorium for expanded lunch capacity).

Lunchtime brings a distinct set of challenges. Masks cannot be worn while students are eating, and many schools typically hold lunch in crowded lunchrooms. To limit the number of contacts of students and staff and maintain group distancing, schools may serve lunch in classrooms at students' desks or in alternative lunchrooms (e.g., repurposing the gymnasium or auditorium for expanded lunch capacity). If a single large lunchroom is to be used, schools may stagger lunch times, keep classrooms/cohorts together, maintain physical distance, and have all students face the same direction or be seated in a staggered pattern, so there is no face-to-face contact. It may also be helpful to clearly mark spaces where each class/cohort will sit in the shared lunchroom. Instead of students going through a line to be served school-prepared lunches, consider alternative solutions, like using single-serving containers clearly labeled with any allergens in the meal. Schools need to reinforce messaging regarding no sharing of food, utensils, and drinks.

Extra precautions are necessary for times when masks cannot be worn, such as when eating or drinking. Ideally, these activities should occur outdoors, weather permitting. If indoors, engineering controls should be enhanced. This includes opening windows during times when students are actively eating, even in cold weather, and even if the windows can only be opened a few inches. Additional options include increasing outdoor air ventilation rates through mechanical systems, increasing filter efficiency, and supplementing portable air cleaners with HEPA filters.

Rethink transportation

- Open all windows on the bus, even a little, and even in bad weather
- Reduce the number of students in each school bus to allow for physical distancing, if possible
- Modify school start times to allow students who use public transit to avoid rush hour
- Encourage walking, biking, or use of personal vehicles

School policies regarding transportation to and from school will largely depend on the primary mode of transportation of students. For reducing viral transmission, the safest routes of transportation are walking, biking, or personal vehicle. There may be ways to promote use of these modes of transportation; for example, walking school bus programs for elementary schools, or the addition of more crossing guards and bike racks. Local police departments should be engaged to help with safety protocols across extended walk zones.

If students are driven to school, the school may organize drop off locations and/or times so that students can be dropped off at the door while limiting disruptions (e.g., to nearby roadways, in coordination with local police departments) and minimizing contact between students not in the same class. After school, cars can line up in the parking lot or adjacent streets, and students can meet their parent or guardian at their car. This will reduce the number of people waiting at school doors. High schools may consider designating extra parking lots or street spaces for student parking if it is anticipated that more students will be using personal vehicles.

Keep windows open on buses, and wear masks. Even opening windows a few inches can greatly increase the amount of ventilation inside the school bus. Students will need to dress appropriately while on the school bus, because windows should be cracked open even when the weather is cold outside and when it rains. Schools may also consider hiring more buses or having buses complete multiple routes so that fewer students are on each bus, although we recognize this option presents massive financial and logistical challenges. Depending on the routes and number of buses, some schools could consider designating a separate bus for each class group in order to maintain group distancing between students from different classes. Assigned seating could help facilitate physical distancing, with vacant seats clearly marked. For example, one student seated per bench on both sides of the bus, skipping every other row or one student seated per bench, alternating rows on each side to create a zig-zag. Seating students starting from the back of the bus to the front could help maintain physical distancing. Consider having an additional bus aide to ensure students maintain a safe distance, as long as it's possible for the aide to also maintain appropriate physical distance.

Schools where students take public transportation can start school before or after rush hour so students are not taking crowded buses and trains. This would reduce the risk of exposure for both students and other community members on public transportation. Students should wear masks on public transportation and wash hands immediately after exiting a subway or bus.

Modify attendance

- Modify attendance policies to facilitate cleaning, reduce class sizes, and/or maintain group and physical distancing
- Allow for flexibility in attendance policies as situations change
- Modify attendance if community spread metrics exceed targets before moving to a fully remote learning platform, and prioritize in-person learning for youngest grades

Three attendance-based strategies to reduce transmission risk that have been proposed are staggered attendance, split attendance, and phased re-entry. Staggered attendance is when students, perhaps based on grade level or class, attend school every other day or every other week. With split attendance, half of the students in the school may attend class in the morning, and the other half may attend in the afternoon. In both strategies, when not physically attending school, students engage in remote learning. Each school could decide the best length of time between group rotations. In phased re-entry, small numbers of students are brought back to school first, such as only kindergarten students or high school seniors, then the number of students in school is increased as case numbers in the area decrease, and the school adjusts to new protocols.

These hybrid learning strategies can be considered when community transmission levels increase before deciding to resume remote learning for all students. However, it is important to note that a hybrid learning model may increase community transmission by increasing students' contacts at home. Parents may need to seek other childcare or playgroups for the days that their child is home, and these additional contacts make it easier for the virus to enter the school community. Schools may need to dynamically adjust their attendance policies as new cases emerge in the school or surrounding community and based on which interventions are working effectively. This does not have to be an 'all or nothing' approach. Controls should be scaled up if community spread rises, and districts should consider age-specific strategies that prioritize keeping young learners in school before widespread, blanket school closures. For example, if community spread increases, districts should consider moving high school to remote before middle schools and elementary schools. For more in depth information about recommended threshold transmission rates for adjusting interventions, reference our report with Harvard's Safra Center for Ethics and Harvard Global Health Institute, available here: https://ethics.harvard.edu/covid-19-response.

Splitting attendance should be considered very carefully because it presents significant challenges for society and school operations. For example, many teachers have children of their own in other school districts. If these policies are implemented, teachers with children will not be able to report to school to teach if their child in another school has a dedicated school-from-home week.

HEALTHY ACTIVITIES

Schools are an avenue for participation in a number of activities outside of the traditional classroom environment. As much as possible, these activities should continue to be provided to students to support engagement, health, mental wellbeing, and development.

Provide recess

- Do not limit children's access to recess, the schoolyard, or fixed play equipment
- Wash or sanitize hands before and after recess or using high-touch equipment
- Increase supervision to limit high-risk behaviors
- Stagger recess times, or, if necessary, separate classes by schoolyard area

Recess, often the only opportunity to participate in unstructured free-play during the otherwise structured and sedentary school day, is beneficial to children's development of autonomy, participation in physical activity and various sensory and physical experiences, practice of social and motor skills, and attention restoration. As different areas of the schoolyard afford different levels of physical activity, types of play, and social interactions, consider the impact of new recess policies on children's ability to confer the benefits of recess. Schools can develop strategies to reduce the risk of COVID-19 transmission in order to allow for continued use of fixed equipment (play structures) and portable equipment.

One of the most important steps that can be taken is for children and teachers to wash their hands with soap and water both before and after recess. Hand sanitizer containing at least 60% ethanol or 70% isopropanol can be used in situations when this is not feasible. Schools may consider having students use hand sanitizer before and after using high-touch equipment (e.g., fixed equipment or play structures). Supervision could be increased to ensure safe practices are followed, particularly during high-risk times (start/end of recess) and in high-risk locations (enclosed or small, hard-to-see places on fixed equipment, or anywhere with high child density). Supervisors should maintain physical distance from students and continue to wear masks. Physical distance between students should be promoted as much as possible. Schools may consider offering physical activity options that allow students to maintain physical distance while they are playing. However, transient interactions while masked are lower risk and should not be used as the basis for limiting all activities.

Ideally, recess times could be staggered so that children in different classes or cohorts would not interact (to maintain group distancing). If classes or cohorts must share the same recess time, entry and exit times could be staggered, or different entry and exit locations could be used for each group. If the schoolyard is large and diverse enough to provide adequate space and variety to each class (including access to all types of schoolyard locations and equipment), classes or cohorts could be provided with designated spaces on the schoolyard in which to play (if recess times cannot be staggered). These designated spaces could be rotated frequently (e.g., daily, weekly, depending on the variety available) to provide children access to a variety of schoolyard experiences.

Schools can allow use of shared portable equipment (e.g., balls, wheeled toys) as play with portable equipment promotes physical activity and allows children to practice motor and social skills. Shared equipment can be disinfected between each class/cohort, and students should wash hands after using shared equipment. Schools may also allow children to “sign out” pieces of equipment and clean each piece between uses. When possible, schools could consider how to modify games/activities to promote safe play. For example, the game “tag” could be replaced with “shadow tag,” in which children step on each other’s shadows instead of touching each other directly.

Modify physical education

- Hold physical education classes outdoors when possible
- Modify activities to limit the amount of shared equipment
- Choose activities that limit close contact over those with a high degree of personal interaction
- Limit use of locker rooms

Physical education aims to develop children into physically literate individuals who have the skills, fitness, and motivation necessary to participate in physical activity across the lifespan. Importantly, while both facilitate physical activity participation, recess and physical education have unique benefits and should not be substituted for one another.

When designing lesson plans, schools could choose activities that limit the amount of shared equipment (e.g., children rotate through stations and equipment is cleaned before/after each use) and contact between students (e.g., children have their own pool noodle to tag others with instead of their hands and to remember to keep distance). As some children may be less physically fit due to limited participation in activities over the previous months, schools could apply progressive overload to allow for safe, gradual increases in workload. Physical distancing, washing hands, and healthy building strategies are particularly important during indoor physical education due to increased breathing rates of students. Locker room access should be limited or staggered. Furthermore, physical education is much more than just physical activity, so schools may consider focusing on teaching the components and values of physical activity and physical fitness, as well.

Reimagine music and theater classes

- Replace higher-risk music and theater activities with safer alternatives
- Move outdoors
- Increase space between performers

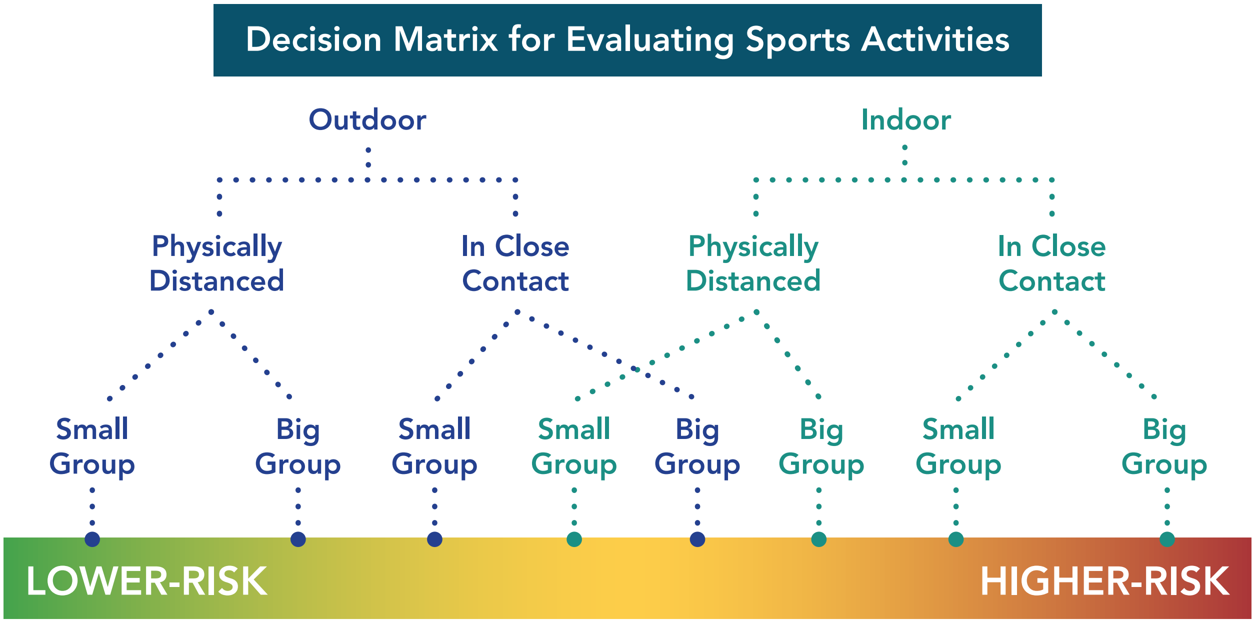
Music education is associated with numerous benefits, including higher academic scores, better memory recall, and the development of areas of the brain related to language and reasoning. Music and theater education should continue, but there are ways they can be made safer. Instruments that do not involve blowing air from the mouth, such as percussion or strings instruments, could be used instead of higher-risk wind instruments, which have the potential for spread of aerosols and droplets because masks cannot be worn while playing. Singing and voice projection are also higher-risk activities that carry a higher risk of viral transmission because of the higher emission rates of aerosols and droplets. Indoor instruction of these higher-risk activities can be replaced with outdoor practice (weather permitting), music theory, theater history, or vocal anatomy lessons. Another option is to continue online instruction for certain instruments, choirs, or ensembles, or practice outdoors in smaller, well-spaced groups. If schools decide to practice indoors, additional precautions are necessary. Practice should only take place in rooms with enhanced ventilation and filtration and where maximum physical distancing can be achieved (minimum six feet). Additional distancing beyond six feet is required for unmasked wind instrument players. Masks should be worn at all times for string instruments players, singers, and performers who are projecting their voice, and for wind instrument players at all times when not actively playing the instrument (e.g., during instrument setup, between songs).

Additionally, all equipment, even student's personal instruments, should be cleaned routinely. Smaller music spaces such as individual practice rooms may be difficult to properly ventilate, so there should be time set aside to keep the door open and clean the room in between uses, or the rooms can be temporarily closed. In theater classes, it may be preferable to focus on rehearsing monologues, remote performances, more performances with small casts that do not require close interaction or performances that can be rehearsed outdoors.

Continue sports with enhanced controls

- Offer every sport if the right controls are in place
- Play outdoors as much as possible
- Limit time spent in close contact and in big groups
- Limit shared equipment, shared spaces, and the number of contacts of the team
- Modify the season schedule and restrict game attendance if feasible
- Analyze each element of practices and games to identify ways to reduce risk
- Wear masks
- Wash or sanitize hands before and after practice, games, or using high-touch equipment

Sport participation offers students a number of psychological and physical benefits and drives physical activity both in childhood and later in adulthood. The risk of transmission for each sport will depend on a number of factors, so decisions regarding specific sports will need to be nuanced. All sports carry some risk of transmission, and that risk varies by the activity. For example, some sports may be a higher risk during competition but can be a lower risk during practice and drills. But even for sports with lower overall risk, there can be periods of higher risk times during practice or in the locker room. The overall risk is not necessarily about the sport, per se, but about the activities taking place within each sport. The flow chart provided in this section may help decision-makers identify the overall risk level of sports activities across three factors: location, distancing, and group size.



Outdoor sports may be less risky than indoor sports, so hold as many practices and games outdoors as possible. Individuals being in close contact increases risk of transmission, so strategies to limit close contact of players should be employed. For example, limit full gameplay to competitions and focus practices on other elements of skill development. Also, consider limiting the number of competitions in a season overall or hold within-team or within-school competitions. To the extent possible, teams should avoid competing with teams that are not local or not part of their conference or league. If big groups are present during the sport, implement strategies to de-densify (e.g., alternate work out days/times for different parts of the team) and maintain physical distancing as much as possible. Teams may also consider ways to shorten the duration of time spent indoors for a particular practice or competition when feasible.

Regardless of overall risk level, there are some strategies that can be implemented in all sports to reduce risk of transmission. An overarching goal is to limit shared spaces and close contact. This means not using locker rooms or staggering locker room use, and avoiding team huddles and high fives, and washing hands or using hand sanitizer frequently. In-person meetings (e.g., team meetings) should take place remotely, outdoors, or in spaces where physical distancing can be maintained. Workouts, practices, and drills could be completed individually or in small cohorts to maintain physical distancing and so that equipment can be cleaned between uses. A certain number of practices per week could also be dedicated to at-home workouts.

Consider limiting the number of competitions in a season overall or hold within-team or within-school competitions. To the extent possible, teams should avoid competing with teams that are not local or not part of their conference or league.

The number of people in direct contact with the team and/or staff can be reduced by eliminating or limiting the number of attendees and other non-essential personnel at sporting events. Physical distance between spectators should be maintained, and schools should clearly mark six foot distances in lines, hallways, and/or seating. Spectators, if allowed at all, should wear masks and be asked to bring signs and applaud the players instead of yelling and cheering; playing music on a loudspeaker at certain times during the event may help improve energy without the cheering.

To limit risk during practices and competitions, players, coaches, and attendees should wear face masks at all times, including on the sidelines/bench, in locker rooms, and/or during gameplay. To ensure anyone wearing masks stays hydrated, they should be encouraged to take mask-free water breaks, while physically distanced from others and while following safe mask removal techniques (e.g. only touching the mask from its straps). Team members could have a spare in case the mask gets too sweaty. In addition, coaches can create areas far removed from other people and near areas of good ventilation where athletes can take short mask breaks (e.g., near the gym door). Athletes with asthma or other breathing problems should consult with their physician if there are concerns about mask use during physical activity. Finally, coaches are recommended to analyze every element of practices and games to identify ways to reduce risk, such as using hand or electronic whistles instead of whistles that touch the mouth, and to consider sport-specific strategies.

Add structure to free time

- Establish occupancy limits and clear physical distancing guidelines in common spaces like a library or cafeteria
- Encourage students to remain outside when not in class
- Replace unstructured time with supervised study halls, if feasible

Children in older grades often have more freedom than younger children. Although breaks from classes are important, safety precautions need to be maintained. When possible, schools could have students spend free blocks outside where there is more fresh air, and physical distancing is easier. If inside, schools may consider assigning student classes to specific common spaces (to preserve group distancing), putting limits on the number of students allowed in each space, and creating clear rules and demarcations on how to maintain physical distance. To limit unsupervised time further, schools may consider entirely replacing free blocks with supervised study halls.

When possible, schools could have students spend free blocks outside where there is more fresh air, and physical distancing is easier.

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