

## Preparing School for COVID-19

The risk of COVID-19 to children is low. The risk of mortality from symptomatic COVID-19 cases in children appears to be about one in 9,000 or less, with lower risk for younger children than for teenagers. Early estimates derived from data from New York City (NYC) suggest that by the time 21% of the population had been exposed, there were 3 pediatric deaths. Thus, if the population of persons under the age of 18 in NYC is 1.74 million, and one in five had been infected, that would suggest an infection fatality rate of one death per 116,000 cases for this age group. Thus, while the risk from COVID-19 is certainly not insignificant, it is small when compared to adults. The risk to healthy children is likely even lower. There are about 50 million children aged 6 – 17 in the US. If every child attending K-12 school was exposed to upper airway contagion with SARS-CoV-2 virus, this estimate would predict 500 additional deaths in this age group from COVID-19. The overall background mortality rate from children 5 -14 years of age is 13.6/100,000; thus, COVID-19 could increase the risk of death by about one-tenth. Underlying disease is a risk factor for children.

The predominant threat from COVID-19 is to adults, and especially those with hypertension, obesity, and diabetes, coronary artery disease and other chronic medical conditions. There is increased risk with old age, in large part as a result of the prevalence of chronic disease in these persons. The infection fatality rate for persons over the age of 65 is above one in 50, and can easily be as high as one-in-ten for older adults with chronic disease (but lower than one in 50 for those without chronic conditions). Thus, the major risk of children attending school is not to risk to the children, but to their older family members, and especially to their grandparents who may be living with them or helping care for them. Additionally, there is considerable risk to teachers and other school staff.

A recent report found that 95% of inmates at one prison tested positive for the SARSCoV-2 virus. This is a highly infectious disease that spreads very quickly. Schools are excellent environments for spreading disease. Children, especially young children have poor hygiene and spread infectious diseases readily. COVID-19 readily infects children, and is transmitted by them, but usually as an asymptomatic disease. Once in a typical school, the disease would spread quickly, likely peaking and falling within several weeks with a high penetration rate. A return to normal school operations in the fall of 2020 would very likely create a severe epidemic, causing the death of over a million Americans unless the situation changes before September.

One way, likely the best way, to prevent the massive loss of life from COVID-19 in America is the vaccination of all high risk individuals. It will likely take at least a year to develop, test, manufacture, and administer this vaccine to over 100 million at risk adults in the United States of America. In an optimistic projection, a vaccine might be ready for widespread use by February or March of 2021. It is highly unlikely to be ready before the end of 2020. Thus, we should not expect it to be ready for the fall semester of school.

A second way to stop the epidemic is for social distancing and use of masks to get the number of infection down low enough that there can be testing and contact tracing of every case followed by quarantine of and testing of contacts and thus reducing the number of cases to near zero. This will take a massive coordinated effort by all the states. This could keep the number of cases

low until there is a vaccine. People should wear masks in public and work situations where there is risk, wash hands, and avoid high risk gatherings until the epidemic ends or until all high risk individuals have been vaccinated. Even if we end the current outbreak in the United States, without vaccination it will likely reemerge as world-wide vaccination seems unlikely as the disease is highly infectious and mutates easily.

A third way to mitigate the loss of lives between now and the vaccination of most high risk persons is to isolate all high risk persons, while allowing social contact among low risk individuals. This is a risky proposition. This would allow healthy young people to have normal social contact, allowing the spread of the disease among them, while avoiding contact with high-risk individuals until the young person has developed IgG immunity. The possible benefit would be to develop herd immunity among enough of the population that disease does not spread rapidly. High risk persons would still have to socially isolate from each other. A much better strategy would be to first protect the high risk population with vaccines.

We don't know how long natural SARS-CoV-2 immunity lasts after an infection, and we will not know how long immunity from vaccination lasts until it fails. Immunity may only last one or two years, or perhaps less, and then the pandemic can reemerge. Without continued vaccinations, this virus is likely to cause disease well into the future.

## Back to Schools

Although children infected with SARS-CoV-2 are mostly asymptomatic and usually only have mild disease if symptomatic, they are no less susceptible to acquiring the infection or spreading the infection. Young children often do not self-monitor hygienic behaviors, and thus are more likely to spread this infection. Young children are also more likely to spend time with their grandparents than are older children, more likely to hug, kiss and touch the faces of adults, and thus more likely to spread the infection to persons at higher risk. The essential task in returning children to school is not so much to protect children from exposure to the virus, but rather to protect school staff members as well as the family members of the children until we have a vaccine to protect these adults.

### Young children (Pre-K to 1<sup>st</sup> grade)

Children this age have the highest risk of spreading the disease and highest risk of conveying the disease to those at high risk of mortality. In general, children this age are too young to do online class work.

I suggest an educational policy of compartmentalization for young children to at least 1st grade. In practice, classes for the youngest school aged children this should be limited to 8 - 12 children. They should be with one teacher all day, preferably with an assistant – in an off campus building. Preferably, the “school room” would be in a neighborhood close to where the child lives. This would isolate the children to a small group and limit contagion to and from the

small group of children. If the group did have an outbreak of the disease, it would at least be limited and easier to contain than an outbreak in a larger school.

An off school-campus building would be needed, perhaps renting space from churches or even renting homes with enclosed back yards. Educationally, a class size of 8 to 12 children is a near ideal for learning language and teaching children this age. Preferably the children could be kept at this location until around 4:00 P.M. until a parent or guardian picked them up, so that the children could avoid a secondary point of contagion at an afterschool daycare. Work places should accommodate workers so that parents of young children can leave work in time to pick up their child by 4 P.M.

The teachers of these children should be limited to lower risk teachers and teacher aids. (Younger teachers without underlying disease.) Although I do not have data to confirm this, I think I doubt that children this age will be sufficiently compliant to wear masks effectively and I consider that for children to learn effectively at this age, they need to hear the teacher clearly and see the teachers face and lips.

#### Elementary Schools (2<sup>nd</sup> through 6<sup>th</sup> grade)

Elementary schools may be able to function without undue risk to the community.

Children and teachers would need to have washable masks, and wear them when outside of the classroom other than on the playground. They should have a mask for every day of the week as children will likely forget them. Children should be required to wear them to get on the bus or be dropped off at school. Bus drivers that are at low risks from the disease should be hired. (In my experience, many bus drivers are people at high risk of severe COVID-19.)

The schools should compartmentalize. One teacher should be with the same children all day – every school day to prevent spreading the disease from one classroom and one class group to another (and from students to other teachers) as much as possible. Cafeterias should not be used. Meals should be eaten in the classroom. Since the children will be eating in the classroom, and not using masks during this time, it does not make much sense to try having the children wear the masks throughout the day.

Recesses and outdoor play should be scheduled so that each group does not interact with other groups. Children should be released in “stages” according to the bus they are to board, wearing masks, so that the hallways are less crowded and less chaotic.

As with younger children, younger healthier teachers should be assigned to teach these grades.

Sanitation and cleaning of the school are discussed below.

## High School (7<sup>th</sup> through 12<sup>th</sup> grades)

High school students attend multiple classes during a day so there high probability of exposure to a large number of persons. In public high schools, there is typically a rush of perhaps hundreds of students in crowded hallways between classes with ample risk of exposure.

Most high school students should be able to take their coursework online. If well done, this may even be beneficial, as it will prepare these students for on-line college courses and for work of the future where a majority of jobs will likely have an online component. This terrible event should be used as an opportunity to develop successful online teaching, learning, and collaboration skills for all high school students. They should thus be able to take these skills with them into their careers.

I suggest schools dedicate resources and training of teachers for doing online teaching for the 2020-2021 school year during the summer recess. By the end of the coming school year, there should be SARS-CoV-2 vaccines available to protect those at high risk from SARS-CoV-2, thus allowing students to return to campus.

Teachers at higher risk of severe COVID-19 should be assigned to doing online teaching of high school.

## Special Education and Special Situations

Special education students, remedial students, and some other students will require different situations. Some students with health issues or who live with high-risk adults may need to home school or do online classes even at lower grade levels. These online/remotely taught students can be taught by teachers who are at high risk, and thus those teachers can teach from home.

Special education, or just less focused, students may not be sufficiently adept to online or remote learning. This may require these students to attend a physical classroom. In this case, the class size should be limited and taught by a teacher who is at low-risk. Similar constraints to those recommended for middle school should be used to compartmentalize possible infections and to protect the families of these students.

## Personnel Requirements

Additional personnel will be required to accommodate the small class size for preK – 1<sup>st</sup> grade. A back-of-envelop estimate puts the number of additional new teachers needed at 325,000. Thus I suggest the near immediate recruitment of young, healthy college graduates to fill these positions, so that they can do early childhood education classes and other appropriate training over the summer months to prepare for the coming school year.

It should also be anticipated that many higher-risk teachers and school staff will do a personal risk-benefit analysis and decide that they would rather not return to the classroom so as to not

risk getting or bringing COVID home to high risk family members. If these teachers are not able to switch to online teaching, many will quite, retire, or sit the year out. Schools need to prepare to move teachers to online work, or prepare to replace a sizable population of teachers. If teachers who perceive themselves (or their family members) to be at high risk are not allowed to teach from home, we could easily lose 10 percent or more of all teachers across the country.

## Funding

Funding will need to be provided for the additional personnel, equipment, training, and off-school rental, and other costs associated with these adaptations to the educational system. It should be anticipated that there will be a surge in persons retiring and claiming pension benefits, including, but not limited to the educational field.

## Colleges and Universities

For the 2020-2021 school year courses should be taught online. This will likely change which classes may be taught, and will delay certain courses, such as lab courses.

## Physical Barriers to Spread of the Infections in Schools

Several interventions can be done which may lower the risk of respiratory disease contagion in schools. Here are ideas –some are better than others.

Open windows when weather permits to circulate in fresh and circulate out room air.

Use HEPA filters in the HVAC systems to trap aerosol droplets. UVC lights can also be placed in the HVAC system to kill bacteria, mold and viruses.

Raise the classroom temperature to 74 – 76 degrees to decrease the time respiratory droplets remain aerosolized. This may be more effective if done after class hours.

In the warmer months after class hours, turn up the temperature settings of the air conditioning system to allow higher temperatures that decrease viral survival time.

Wipe down desk tops and seats with 0.1 percent bleach solution after school each day during respiratory viral outbreaks.

Clean bathrooms twice daily. Mist bathrooms with H<sub>2</sub>O<sub>2</sub> at the end of each school day.

UVC lights can be installed in school bathrooms that run on a timer cycle and automatically shut off, if the bathroom is occupied.

Stop using cafeterias and limit or discontinue the use of study halls, gymnasiums, and libraries.

School lunches should be given as bag lunches, and either eaten in the classroom. When the weather is pleasant, encourage children to eat out doors, but only with their class group.

If lunch trays are used they should be cleansed with 0.5 % bleach solution between uses.

For the Future:

School ventilation/HVAC systems in any new school building should be designed to limit person to person transmission of respiratory disease and as well, to limit exposure to allergens that provoke asthma. We know how to design ventilation systems that limit noise and pathogen transmission from one classroom to another, but this has not been a high priority. Every year infections and asthma cause high numbers of missed school days. Schools should be designed to limit the spread of infections and disease.

Children should be vaccinated against the flu every year at the school, and only exempted with a doctor's note. (Read about the [Adenoid Riots](#) for an interesting insight to school health history)

Other Issues:

Many sports will be limited during this time. Physical activity should be encouraged. Cross country running and biking should not increase risk of disease transmittal.

Socialization and dating is an important part of high school. Some students may need help or assignment to online groups to help them find a "club" where they fit in and can make friends. This may be limited to online relationships for a year. I recommend that high school students be required to be part of at least one online "club", group project, or other social group.

Young musicians will not learn to listen to each other playing in bands. Voice and wind instruments will spread disease and should not be played in group or public settings. Stringed instruments and percussion should be fine.

Lab classes, some of which may be required for graduation or college admittance may need to be adapted to activities that can be easily done in the home, performed by example, or the requirement suspended for the year.

General Society

As with schools, work places should need to accommodate high-risk adults, allowing as many as possible to work from home or in low exposure environments until the danger to this population has largely abated. Low-risk individuals should be assigned to positions where disease transmission is more likely, but protective equipment should be supplied in any high risk situation. A young healthy person who is a low personal risk, but who lives with high-risk individual, should not be assigned a position where risk of contagion is high, unless they are

shown to have developed immunity. No one should have to choose between their livelihood and risking their life or the life of a family member.

With the new 2020 census, the federal government has an accurate database of the age, gender, and address of most of the population. The government should send two age/gender appropriate washable protective masks and safety to each person that has completed the census. This would supply protection to country much less expensively than the shutdown, and encourage those who have not completed the census to do so.