

School reopening: Back to classroom. A systematic review of strategies and their implementation during COVID-19 pandemic

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ABSTRACT

School closure has affected millions of students worldwide. After more than a year of school closure, steps have been taken to re-start in-person schooling. These strategies have worked well for many setups; however, there are some gaps that have led to repeated sessions of closure and reopening of schools. We have studied these plans of reopening schools and looked into changes that can improve their execution. In this study, we have studied the impact of school reopening in the transmission of SARS CoV-2 in various countries, both developed and developing nations. We have reviewed the measures taken in different countries to reopen schools. We have studied how effective these measures were so as to chart out plans from them to execute our strategies in the country. Both urban and rural setups have been taken in to account. We have searched the electronic databases, PubMed and MEDLINE, and bibliographies of relevant studies were included. We have used the keywords “COVID-19,” “school,” “reopening,” “prevention,” “strategies,” and “transmission.” We have manually searched for studies addressing school reopening during the COVID-19 pandemic. PRISMA approach has been adopted to study the articles systematically. After reviewing different studies on school reopening, a low transmission rate among students was noted in 12 out of 13 studies. Measures such as hand hygiene, masks, and contact tracing are fundamental in preventing the spread of infection in schools.

Keywords: COVID-19, prevention, reopening, school, strategies, transmission

Background

Schools lay the foundation of a student’s mental, physical, and social well-being, apart from playing a major role in the cognitive development. Schools were the first institution to get closed when the pandemic hit in March 2020 in India. Worldwide, the pandemic has affected the well-being and education of more than 888 million children, which is a huge number and is thus concerning.^[1] In India alone, the number of children impacted is 247 million.^[2] In a developing country like ours, 65% of the

population lives in rural areas where there is a dearth of resources and looking forward to digital education and internet access is a far-flung dream.^[3,4]

Pandemic has exhausted people of their savings, and many have lost their jobs. The economy has shrunk and affected daily wagers and economically weaker sections the worst. Amounting to their financial burden, vulnerable groups such as girls, people with disabilities, and children of low socioeconomic status are unlikely to return once schools reopen.^[5] Schools play a strong role in preventing child labor, abuse, and early marriages in children. These learning centers also provide nutrition, medical access, and mental health and development. Besides all these considerations, children are developing mental health

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concerns; pediatricians and physicians have reported an increase in cases of mood and anxiety disorders, substance use, social problems, and neurodevelopmental disorders.^[6] There have been reports of cases of increase in myopia among children and adolescents.^[7] This has led to an increase in visits to family physicians and pediatricians. Indoor lifestyle and longer screen time are affecting the overall growth of children, mandating the reopening of schools with all safety and transmission precautions.

Considering this education emergency a priority, we have to chart out measures to reopen schools in the country, which is a challenge, particularly in rural areas. In this study, we have reviewed strategies adopted so far and have attempted to derive the best possible strategies suited in developing countries.

Significance of the Study

Currently, there is no published data and guidelines in the country so as to guide school reopening strategies. Most of the measures to reopen schools have been done in developed countries and cannot be executed in low-budget settings. Our policies would help in the implementation of strategies in different cultural and social settings.

Aims and Objectives

- I. To study impact of school reopening in the transmission of SARS CoV-2 in various countries, both developed and developing nations.
- II. To review measures taken in different countries to reopen schools.
- III. To review the effectiveness of all the strategies being followed in different countries to prevent the transmission of COVID-19 in schools.
- IV. To chart out plans for execution in both urban and rural settings in the country.

Project Description

Study method: We have systematically reviewed the published work on COVID-19 transmission in schools and measures taken to reopen schools during the COVID-19 pandemic. We have accessed the electronic databases, namely PubMed, National Center for Biotechnology Information (NCBI), United Nations Children’s Fund (UNICEF), World Health Organization (WHO), Ministry of Health and Family Welfare (MoHFW, India), Indian Council of Medical Research (ICMR), European Center for Disease Prevention and Control (ECDC) and Center for Disease Control and Prevention, up to August 2021, and bibliographies of relevant studies were included. We have manually searched for studies addressing plans to control COVID-19 in schools. We have also looked for the reference lists of articles. Articles other than in the English language were excluded.

Review of Literature

While searching for COVID-19 transmission studies, we came across 255 studies. The studies included transmission in schools after reopening during the pandemic. The following diagram explains the flow of search design: The following diagram explains the flow of search design [Figure 1].

Studies included different countries and were heterogeneous in design.

Studies have concluded [Table 1] that reopening of schools in pandemic has a minor contribution to transmission. Outbreaks among teachers were more both in secondary as well as primary schools. Schools need to implement stringent measures for prevention of infection in secondary schools.

Measures Taken to Contain Transmission in Schools

Countries such as Denmark, Japan, and China have made handwashing compulsory in schools.^[21-23] This is the most fundamental step in disease prevention. As per data, only 43% of schools across the world have the facility of handwashing with soap and water.^[24] Developing countries like Tanzania took an initiative to improve their handwashing facility wherein masses were educated and the government provided sufficient resources for hand hygiene. Distribution of hand sanitizers in police stations and public offices was done.^[25] In a study by Jeremy Herbet in Australia, a handwashing station was installed in a school and was used actively for 10 days. It was noted that during the 10-day study period, no outbreak occurred.^[26]

In Israel, schools were reopened in May without making masks compulsory; this led to an outbreak of COVID-19 and schools were shut down again.^[27] In France, masks were made compulsory

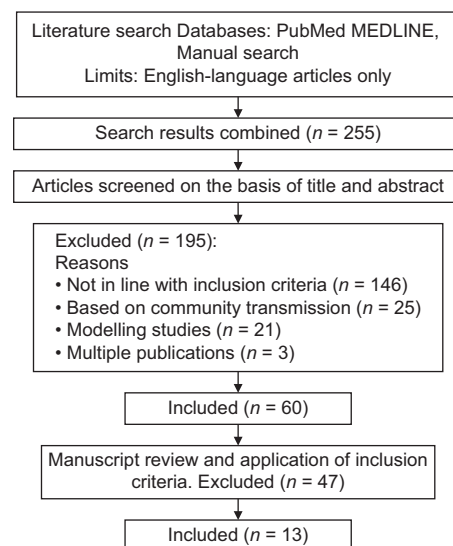


Figure 1: Flow diagram of study selection

Table 1: List of included studies related to transmission of COVID-19 after reopening of schools

Observation time	Study	Type of study	Sample size	Conclusion
Jan 2021	Walsh S <i>et al.</i> ^[8]	Systematic review of 150 countries	150 countries	Low risk of transmission
Aug 31-Oct 18, 2020	Felicity Aiano <i>et al.</i> ^[9]	Cross-sectional national surveillance (England)	130,946	Transmission more in secondary schools, more in teachers.
Mar 2021	Busa F <i>et al.</i> ^[10]	Narrative review of countries worldwide	Not described	Low risk of transmission
Jun 1-Jul 31, 2020	Wada K <i>et al.</i> ^[11]	Investigation of confirmed cases among teachers and students after reopening of schools in Japan	9,586,687 students 668,760 teachers	Low risk of transmission among students; transmission more in teachers
Feb 28-Jun 20, 2020	Shirley Shapiro Ben David <i>et al.</i> ^[12]	Retrospective database cohort study in Israel	1032	No change in transmission dynamics
Sep 14-Oct 18, 2020	Anna Llopia <i>et al.</i> ^[13]	Retrospective cohort study in all public schools in Catalonia (Spain)	778,715	Contributed to transmission
Sep-Nov, 2020	Darria L. Gillespie <i>et al.</i> ^[14]	Prospective study of 2 independent large K2 schools in US; included periodic universal testing	3699	Low risk of transmission
Dec 3, 2020-Jan 31, 2021	Rebecca B. Hershow <i>et al.</i> ^[15]	Investigation of 20 elementary schools after reopening in Salt Lake County, Utah	1041	Low risk of transmission
Jun-Dec, 2020	Shamez N Ladhani <i>et al.</i> ^[16]	Prospective surveillance study in all primary schools by Public Health England	11966	Low risk of transmission
Dec 1, 2020-Jan 22, 2021	Jeremy A. W. Gold <i>et al.</i> ^[17]	Investigation of 8 elementary public schools after reopening in one school district in Georgia	3300	Teachers play a role in transmission
Aug 15-Oct 23, 2020	Zimmerman, K. O. <i>et al.</i> ^[18]	Investigation of 11 school districts in North Carolina	>90.000 students	Low risk of transmission
Aug 10-Dec 21, 2020	Doyle T <i>et al.</i> ^[19]	Investigation of private and public schools after reopening in Florida	15,306	Low risk of transmission
Aug 28-Nov 11, 2020	Brandal LT <i>et al.</i> ^[20]	Prospective approach to trace and systematic testing of contacts in primary schools in Oslo and Viken countries, Norway	9,416	Low risk of transmission

in secondary schools only.^[28] Denmark also started schools without making masks compulsory, but other transmission preventive measures were followed vigorously.^[21] In Japan, masks were made compulsory for all students and staff at all times in schools.^[22]

There are studies stating the significance of masking in different age groups in children in influenza-like respiratory illnesses; less than 5 years show less protection from mask. Children from 9 years onwards are majorly benefitted. The reason could be ill-fitting masks in the younger population.^[29] AAP recommends and supports the use of masks in kids who are more than 2 years during the COVID-19 pandemic.^[30]

Belgium, Denmark, France, Germany, Greece, South Korea, Norway, and Switzerland started schools during the pandemic with a reduced number of students. Denmark further reduced lecture duration per class.^[28] Ventilation of classrooms has been taken as a priority in reopening strategies. Denmark has reserved public parks for classes from 8 a.m. to 3:30 p.m.^[21]

To conclude, handwashing is the most effective measure in preventing COVID-19 infection along with wearing of masks. Outbreaks in schools are directly linked with the rate of transmission in the community. Masking should be the primary transmission preventive measure in schools. Non-essential interactions among teachers and students are expected in schools. Teachers play a strong role in the transmission cycle. They should not be attending large gatherings outside school.

There is a huge responsibility on all of us to contain infection as much as possible. Voluntary quarantine should be the approach in case of exposure.

In view of this, after reviewing various strategies being followed in different countries, we have worked up a plan to implement in schools to start their reopening effectively.

1. Teamwork and workforce

The decision of jumpstarting educational institutions will require workforce and coordinated teamwork.

- a. A special team comprising school staff, students, and management staff has to be assigned, where each one of them can be given a job responsibility for the execution and monitoring of various strategies in schools.
- b. Students can be the fundamental part of this team; for example, a class monitor can observe functioning of some areas and report to the teacher who has been assigned some job responsibility. This will enhance the interest of students in the process. The duties among students can be rotated monthly.
- c. In urban settings, where facilities are available, teachers can update the progress of every day in a school dashboard. In this way, the areas that are lacking can be looked into easily. An incident report of exposure can be updated in the dashboard.

In a setting where internet facility is not available, teachers can maintain a written record wherein an entry can be maintained.

- d. This team should access the progress and concerns weekly to start with and monthly thereafter. This database should be maintained to access the progress of reopening of schools in a region.

2. Awareness

Educating the masses plays a key role in implementing rules and new policies. Schools in China greet students by the “COVID-19 First Class,” a video tutorial designed by the Ministry of Education on how to practice safety measures in schools.^[23]

- a. Parents, students, and other staff at school have to be made aware of the situation, its mode of transmission, and how it can be prevented. Students can be given assignments to educate their family members.
- b. Television, FM radio, national and regional newspapers, and social media can be used for the awareness of people. Influential people like cricketers, filmmakers, actors, and singers can be involved in the process. They can also educate the masses to avoid the stigma associated with the disease in the community.
- c. Slogans can be pasted in schools and in the community both in English and regional languages.
- d. In rural settings, ASHA workers, ANMs, and MPWs should be involved in educating the families.
- e. Family physicians play an influential role in making families aware of how important it is for children to go to schools for their physical, mental, and social well-being and how infection has to be prevented.
- f. Students, parents, and teachers should be given strict instructions regarding the signs and symptoms of the disease. If a child is unwell, he/she should not attend school.

3. Communication network

There has to be a precise but closed communication network between teachers, parents, authority, and students for successful functioning of the program. This communication network has to be vitally active to inform any exposure incident at school where parents can be involved and informed. Emergency numbers of family members have to be submitted. In case there is no mobile phone in the family, a close family member or workplace contact detail can be submitted.

4. Safety and Sanitation precautions

- a. Schedule to educate students and school staff regarding hand hygiene and respiratory etiquettes. Students should be made to wash hands with soap and water. In places where handwashing is not possible, encourage use of hand alcohol sanitizers with minimum 60% alcohol.
- b. Students should be restrained from handshaking. Students should be taught to cover their nose and mouth while sneezing and coughing. Posters can be used in schools for respiratory etiquette education.
- c. Sharing of stationery and books should not be allowed between students.
- d. Written homework in notebooks should not be preferred. Instead, oral exercises can be given.
- e. Temperature check at the entry gate of the hospital should be done. If anyone is having a temperature higher than

normal, he/she should be sent back home and guided about isolation and quarantine measures and precautions. In South Korea, every student has to fill out a health survey at the start of each school day. The survey covers body temperature, COVID-19 symptoms, travel history of the student and the family, and whether any household member is under home quarantine. After going through the survey, the school instructs each student on whether they can enter the institution.^[21]

- f. The water supply system should be safe to use after a prolonged period of lockdown.
- g. Toilets should be clean and have a provision for exhaust air exit. Handwashing facilities with soap and water should be available in all toilets.
- h. Though the transmission rate of the virus is very low via vomitus and oro-fecal route, it should be cleaned immediately to prevent contamination of environment.^[31]

5. Transmission Prevention

- Masks:
 - a. Use of masks should be made obligatory in schools by all, including students and school staff, at all times. An exception to this rule is meal time and while drinking water. Another exception is a disabled child who is unable to wear a mask or unable to take off the mask in times of distress due to it. In special situations such as hot summers where chances of heatstroke are high, students can be allowed to take off their masks briefly if feeling breathless. In such a situation, the person should maintain a 6-foot distance and should not be talking.
 - b. Masks should be of proper fit; sides should be closed, and should cover over the nose and under the chin completely.
 - c. In rural settings, where families cannot afford a fresh mask every day, children can opt for cloth masks, which can be washed on a daily basis and reused. Masks should be of tightly-woven fabric. Cotton and cotton blend fabrics that are breathable are preferred. Families can sew their own double- or triple-layered masks. These masks can be washed and reused, preventing financial burden.
 - d. Masks should be made readily available at schools for students and school staff wherever possible.
 - e. Masks with vents, tears, and loose masks should not be allowed.
- Social distancing
 - a. In classrooms, a minimum of 3-foot distance should be maintained with students wearing masks consistently at schools. In case of high community transmission, 6-foot distance has to be maintained.
 - b. In the case of teachers and other staff (adults), a minimum of 6-foot distance has to be maintained.
 - c. In case of assembly in auditorium or lobbies, a minimum of 6-foot distance should be made obligatory.
 - d. Visitors should be limited in schools; if allowed, social distancing and mask should be made compulsory.
 - e. Rooms should be properly ventilated. Unnecessary items should be removed to create space for distancing in classrooms.

- f. Plastic dividers can be used between benches.
 - g. Meal times should be of minimum duration with a 6-foot distance rule. Meal times can be done in shifts when half of the class goes into the open area and sit at more than a distance of 6 feet and have their meals. Similarly, the other half of the class can have their meal in the other shift. In China, test-room lunch is implemented where cafeterias are set up like an exam room with students eating at their personal tables. Each grade is assigned a staggered timetable for lunch, and students get a bento box rather than lining up at the cafeteria counter. Personal utensils are also encouraged.^[23]
 - h. Standing in long queues should not be allowed outside toilets and drinking water areas. Circles can be marked on the ground at a 6-foot distance for standing to maintain appropriate distance among students.
 - i. Wherever possible in schools, no-touch taps/motion sensor taps can be installed. Elbow taps can be another option. In rural settings where hand pumps are used, foot levers can be used. If nothing goes, appropriate handwashing before and after touching taps should be made compulsory.
 - j. Classes should be divided into batches of 15–20 and should be scheduled into different shifts. Countries such as Belgium, Denmark, France, Germany, Greece, South Korea, Norway, and Switzerland restarted schools with 10–15 students or approximately 50% capacity. There are countries that have not reduced class size like Israel, Sweden, Taiwan, and Vietnam; they are relying on other measures such as closing schools with confirmed cases and using desktop dividers to increase the physical separation between classroom desks and cafeteria seating.^[28]
 - k. Class lectures can be done in open areas such as grounds and assembly areas in small batches whenever possible. In Denmark, parks have been reserved for lectures, and other buildings such as hotels, libraries, museums, and conference halls have been made available to schools for conducting classes.^[21]
 - l. Sitting arrangement should be made such that every student faces one direction. All desks should be placed facing the same direction.
 - m. Proper distance should be maintained in the school transport facility. Consistent mask-wearing should be done. Windows should be open at all times for proper ventilation. Adherence to these practices should be monitored and reported. Common transport facilities should be avoided whenever possible.
 - n. High-touch surfaces should be cleaned regularly twice a day every day with low-level disinfectants.
 - o. Outdoor sports and recreation activities have to be discouraged. These create aerosols and droplets. Indoor quizzes can be planned with students sitting at an appropriate distance.
- 6. Physical and Mental Health**
- a. A nursing officer should be present in the school dispensary. Provision of medical aid should always be there.
 - b. This pandemic has affected families' mental health. A school counselor can be assigned, and students should be guided about self-healing methods such as yoga and meditation. A healthy routine should be emphasized. Japan has recommended a school counselor for the same.^[22]
 - c. Loss of education during the pandemic should be considered, and students should be encouraged to work towards it. Assignments can be given to cover up the loss.
- 7. Management of contact exposure**
- In this scenario, management and communication networks play a major role. Assurance should be given, and panic has to be prevented. Appropriate treatment in case of signs and symptoms should be started. Parents have to be informed and guided about isolation (in case of tested positive) and quarantine measures. Education has to be given to prevent stigma.
- 8. Ad-hoc Recruitment of staff**
- Classes can be divided into shifts wherein less number of students should attend classes in small batches, requiring an increased number of teachers and other school staff. For this, recruitment of staff can be done on an ad-hoc basis. In Japan, MEXT has recommended recruiting retired teachers, education-related NPO staff, and university students for this.^[22]
- 9. Vaccination**
- Vaccination should be made mandatory for school staff. Students' vaccination should be considered when recommended by the government. Parents' vaccination status can be made mandatory for attending the classes.
- 10. Testing**
- Testing facilities can be made available at the pre-commencing of classes. Testing for screening and diagnosis are the two main prerequisites for the same. Testing for SARS CoV-2 antibodies facility can be thought over to. Countries like Germany started antibody testing in schools as a transmission prevention measure.^[28]

Summary

Already known about this topic- The COVID-19 pandemic has led to the closure of schools on a large scale worldwide and for a long time, adversely affecting children in every aspect, be it mental, physical, or social development. Understanding SARS-CoV-2 transmission in schools in different setups is crucial in improving the safety of in-person learning.

Added value by this study- A systematic review of varied studies has shown that reopening schools amid the pandemic with all safety measures does not alter the rate of COVID-19 transmission in the community. More stringent strategies have to be implemented in secondary and higher secondary schools to prevent transmission. Teachers attending schools should not attend large social gatherings. Out of all the preventive measures, masking, maintaining a social distance of 6 feet, and handwashing are the most primary ways for prevention of infection.

Practical implications for public health- After studying the effectiveness of all the strategies being followed in different countries, a list of preventive and safety measures has been prepared for schools in the hope to aid in the process of reopening schools again in different setups in all the countries.

Take-home message: Going to school is an integral part of a child's education and cannot be overlooked for the sake of their physical and mental health. Hence, it is imperative that we devise optimum strategies for the reopening of schools, keeping the risk benefits in mind. The role of family physicians is of utmost importance by spreading awareness and rebuilding trust in society.

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Conflicts of interest

There are no conflicts of interest.

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