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The Lancet Child & Adolescent Health: Effective testing and contact tracing is essential for schools to safely open during COVID-19 pandemic, two studies show

Modelling study suggests reopening UK schools in September must be combined with high-coverage of test-trace-isolate strategy to avoid second wave of COVID-19.

THE LANCET

Effective contact tracing and epidemic control measures are essential for safe opening of schools during COVID-19 pandemic, according to two studies published simultaneously in *The Lancet Child & Adolescent Health* journal.

Modelling the impact of UK schools reopening in September, one study suggests that a second COVID-19 wave could be avoided in the UK, if accompanied by a test-trace-isolate programme with sufficiently broad coverage. The second study, analysing data collected between January and April 2020 in New South Wales (Australia), finds low levels of transmissions in schools and nurseries when control measures are in place.

Children across the globe have been affected by school and nursery closures during the first wave of the COVID-19 pandemic as governments grapple with efforts to reduce transmission. However, school closures may have detrimental effects on children's physical and mental health and wellbeing and have the potential to increase inequality.

There is a lack of evidence on the role of schools in the transmission of coronavirus, with the majority of existing data based on modelling and very few studies using real-world data from schools to investigate outbreaks. Although much still remains unknown about transmission in educational settings, both studies published today point to the importance of the broader context under which schools are re-opened, as well as to the need for further research on the levels of transmission in children and teenagers.

Modelling reopening of UK schools

The modelling study, led by researchers at UCL and the London School of Hygiene and Tropical Medicine, provides the first estimates on the levels of test-trace-isolate coverage needed for schools and wider society to reopen while avoiding a second epidemic wave in the UK.

Using workplace, community, demographic and epidemiological data, the authors modelled six different scenarios of school reopening. These included full time and a part-time rota system with half of students attending school on alternate weeks, each within three testing scenarios reflecting various levels of contact tracing and testing. Alongside school reopening, the model included the relaxation of measures across society, which they assumed would accompany one another. For each scenario, they estimated the number of new infections and deaths, as well as the effective reproduction number (R).

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The results of the modelling suggest a second wave in the UK might be avoided with increased levels of testing (between 59% and 87% of symptomatic people tested at some point during an active SARS-CoV-2 infection), and effective contact tracing and isolation.

For effective contact tracing and isolation, assuming 68% of contacts could be traced, 75% of individuals with symptomatic infection would need to be diagnosed and isolated if schools return full-time in September, or 65% if a part-time rota system were used. If only 40% of contacts could be traced, these figures would need to increase to 87% and 75%, respectively.

However, if levels of diagnoses and contact tracing fall below this across the UK population, reopening of schools together with gradual relaxing of the lockdown measures are likely to result in a secondary wave that would peak in December, 2020, if schools open full-time in September, and in February, 2021, if a part-time rota system were adopted in September.

In either of these scenarios of continual gradual relaxation control measures and insufficient test-trace-isolate, the authors caution that the second wave could result in the reproduction number (R) rising above 1 and a resulting secondary wave of infections 2 to 2.3 times the size of the original COVID-19 wave.

For the main study, the model assumed that children were as infectious as adults. However, since the evidence that the level of infectiousness in children compared to adults is non-conclusive, they also re-ran the model with the assumption that children and young people were 50% as infectious as adults, with the results remaining.

Dr Jasmina Panovska-Griffiths, UCL/Oxford, who lead the study, commented "Our modelling suggests that with a highly effective test and trace strategy in place across the UK, it is possible for schools to reopen safely in September. However, without sufficient coverage of a test-trace-isolate strategy the UK risks a serious second epidemic peak either in December or February. Therefore, we urge the government to ensure that test-trace-isolate capacity is scaled up to a sufficient level before schools reopen." [1]

She continues, "It's important to note that our model looked at the effects of school reopening alongside the loosening of the restrictions across society, as school reopening is likely to go hand in hand with more adults returning to work and other relaxed measures across society. Therefore, our results are reflective of a broader loosening of lockdown, rather than the effects of transmission within schools exclusively, suggesting an effective test-trace-isolate offers a feasible alternative to intermittent lockdown and school closures to control the spread of COVID-19." [1]

Professor Chris Bonell, LSHTM, one of the senior authors on the study, says, "Our study should not be used to keep schools shut because of a fear of a second wave but as a loud call to action to improve the infection control measures and test and trace system so we can get children back to school without interrupting their learning again for extended periods of time. This is even more important in the context of opening up other areas of society" [1]

The authors note some limitations of their study, highlighting that, as with any modelling study, their model rests on a series of assumptions. Although they model scenarios to resemble the UK, some of the assumptions are based on data from different settings.

Although rates of asymptomatic transmission are currently unclear this model assumes that asymptomatic infections account for 30% of onward-transmitted infections. They also note that their study does not account for the behaviour of young people who are not in school and have not assumed increased social mixing outside schools.

COVID-19 transmission in 25 schools and nurseries in New South Wales, Australia

A second, observational study, also published in *The Lancet Child & Adolescent Health* journal, looked at real world-data from January to April tracking COVID-19 spread within 25 schools and nurseries in New South Wales, Australia. The study finds that the risk of children and staff transmitting the virus in these educational settings was very low when contact tracing and epidemic management is in place.

Although 27 children or teachers went to school or nursery while infectious, only an additional 18 people later became infected (out of 1,448 contacts - a secondary attack rate of 1.2%).

The findings suggest that schools and nursery (known in Australia as early childhood education and care; ECEC) centres do not pose a high risk for onward transmission of coronavirus where effective contact testing strategies are in place.

Unlike many other countries, Australia, which had comparatively low COVID-19 incidence during the first wave of the epidemic, kept schools open during the first wave, with guidance in place for physical distancing and hygiene.

"Our findings are the most comprehensive data that we have yet on SARS-CoV-2 transmission in schools and early years education settings," says Professor Kristine Macartney, Director of the National Centre for Immunisation Research and Surveillance and with the University of Sydney, Australia. [1]

The study looked at laboratory-confirmed COVID-19 cases in the state of New South Wales and identified all staff, and children aged 18 and under who attended school or nurseries while infectious (including 24 hours before the onset of symptoms), using the state's centralised reporting system (the NSW Notifiable Conditions Information Management System).

All cases or their guardians were interviewed at diagnosis to track their attendance at school or nursery as well as any contact with other people during the time that they were infectious. All 3,103 schools and approximately 4,600 nurseries in New South Wales were eligible for analysis, which took place over a three-month period from the first COVID-19 case in 25 January to 10 April 2020 (end of school term).

Close contacts - defined as those with face to face interaction for a minimum of 15 minutes or 40 minutes in an indoor space with an infected person - were identified using timetables, interviews with parents and school officials. Once identified, they were monitored (with regular phone calls) and asked to quarantine for 14 days. If they began to show symptoms, they were asked to take a test, allowing the authors to calculate how many secondary transmissions were associated with each primary case identified.

Overall, 12 children and 15 adults were found to have attended schools or nurseries while infectious. These attendances took place across 15 schools and 10 nurseries.

Contact tracing identified 1,448 close contacts who were followed up with regular phone calls and instructed to be tested if they showed symptoms. 633 (43.7%) of these people were tested for COVID-19 after either showing symptoms or if they opted for a test (using either nucleic acid or antibody testing).

Of the 633 close contacts who were tested following symptoms, 18 were found to have COVID-19, meaning that 1.2% of all close contacts (1,448) were confirmed positive.

These 18 secondary transmissions happened in three schools and one nursery. The nursery outbreak was large, and involved transmission from one adult to six adults and seven children (35.1%; 13/37 contacts). Removing this one outbreak from the analysis resulted in a rate of one infection per 282 (0.4%) close contacts for education settings overall.

In a subset of seven schools and nurseries that underwent additional investigations including antibody testing, symptom surveys and extra nucleic acid testing for the virus, the child-to-child transmission rate was found to be 0.3%, and 1.0% for child-to-staff. The rate of staff-to-child transmission was 1.5% and staff-to-staff was 4.4%, suggesting that children are less likely than adults to spread the virus.

Of the total of 1.8 million children in New South Wales, the study identified only 98 children who were infected, accounting for 3.2% of total COVID-19 infections, confirming low rates of disease in this age group.

"The study adds valuable data but it is important to view these findings in the context of the NSW outbreak. It may be that higher rates of transmission occur in areas with higher levels of infection and where contact tracing and public health measures were not as rigorous as in Australia, where borders were closed and quarantine measures were strongly enforced. Schools were also closed temporarily for thorough cleaning if a pupil or staff member was found to be infected." says Professor Macartney. [1]

The one outbreak in a nursery setting was complex and occurred early in the outbreak, when criteria for testing was more narrow. The study suggests that the transmission stemmed from staff rather than children attending the centre, and a number of children were asymptomatic.

The authors caution that there are some limitations to the study, most notably that the majority of close contacts were tested after developing symptoms, suggesting that some asymptomatic or milder cases may have been missed. Furthermore, children were encouraged to stay home for distance learning from March 22 and although schools did remain open, there was a drop in school attendance from 90% to approximately 5% immediately before the school holidays in April.

In a linked commentary discussing both articles, Professor W John Edmunds, LSHTM, says, "Both studies give potential options for keeping schools open and show the clear importance of adequate contact tracing and testing. Macartney and colleagues suggest that educational settings can remain open provided measures, such as contact tracing, quarantine, and even school closures, are in place to limit spread when cases occur. Panovska-Griffiths and colleagues suggest that the safe reopening of schools in the UK could occur if the TTI programme is greatly improved. However, many questions remain, including whether there are age-related differences in susceptibility and the likelihood of transmission between children and adolescents. We urgently need large-scale research programmes to carefully monitor the impact of schools reopening, as Public Health England's sKID study aims to do. Only in this way can we take the most appropriate measures to mitigate the risks and allow us to reassure parents, pupils, and teachers alike that schools are safe to attend. There are no quick fixes to this terrible pandemic. However, it is becoming increasingly clear that governments around the world need to find solutions that allow children and young adults to return to full-time education as safely and as quickly as possible."

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Study 2 was funded by NSW Health. It was conducted by researchers from The National Centre for Immunisation Research and Surveillance, The Children's Hospital at Westmead, the University of Sydney, Nepean Hospital, Australian National University, Western Sydney Local Health District, New England Local Health District, NSW Health, the University of Newcastle and the NSW COVID-19 Schools Study Team, full list at the end of the Article.

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[1] Quote direct from author and cannot be found in the text of the Article.

Peer-reviewed / 1 Observational study + 1 Modelling study / People

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