

VIEWPOINT

Lessons learnt during the COVID-19 pandemic: Why Australian schools should be prioritised to stay open

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In 2020, school and early childhood educational centre (ECEC) closures affected over 1.5 billion school-aged children globally as part of the COVID-19 pandemic response. Attendance at school and access to ECEC is critical to a child's learning, well-being and health. School closures increase inequities by disproportionately affecting vulnerable children. Here, we summarise the role of children and adolescents in Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) transmission and that of schools and ECECs in community transmission and describe the Australian experience. In Australia, most SARS-CoV-2 cases in schools were solitary (77% in NSW and 67% in Victoria); of those that did progress to an outbreak, >90% involved fewer than 10 cases. Australian and global experience has demonstrated that SARS-CoV-2 is predominantly introduced into schools and ECECs during periods of heightened community transmission. Implementation of public health mitigation strategies, including effective testing, tracing and isolation of contacts, means schools and ECECs can be safe, not drivers of transmission. Schools and ECEC are essential services and so they should be prioritised to stay open for face-to-face learning. This is particularly critical as we continue to manage the next phase of the COVID-19 pandemic.

School closures were implemented as an early pandemic management strategy to reduce the transmission of Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2), affecting over 1.5 billion learners globally in 2020.¹ This initial precautionary principle was informed by influenza transmission, where children are key drivers of transmission across all age groups.² However, evidence emerging throughout 2020 suggested that the transmission dynamics of SARS-CoV-2 were quite different from those of influenza. Whereas in influenza, children have the highest rate of disease notification across the age spectrum, for SARS-CoV-2, paediatric notifications are the lowest.^{3–5}

The greatest impact of the COVID-19 pandemic on children and adolescents, especially for the most disadvantaged, has been the closure of educational facilities. Closures create an education gap, with children from lower socioeconomic backgrounds less likely to have access to online classes than their peers from higher socioeconomic backgrounds,⁶ especially in low and middle-income countries.⁷ School closures can cause engaged youth to completely

disengage from education; as many as 10 million children are predicted to never return to school, and 2.5 million girls may be at risk of child marriage in the next 5 years.⁸

In addition to the educational disadvantages, school closures affect children in many ways. The United Nations Educational, Scientific and Cultural Organization (UNESCO) recognises that school closure, even if temporary, can have high social and economic costs.⁹ The structure and face-to-face support that schools provide are vital for students with disabilities and mental health issues, and a safe haven for those experiencing domestic violence.^{10–15} A mental health survey conducted on Australian youth found adolescents aged 12–17 years, particularly those who started high school in 2020, reported higher psychological distress rates and poorer coping strategies than similar-aged adolescents surveyed in 2018.¹⁶ School and early childhood educational centre (ECEC) attendance also offset the risk of families experiencing poverty¹⁷ as children receive meals¹⁸ and for caregivers to maintain employment.¹⁹

Acknowledging that school closures have a wide impact globally on child and adolescent education and health, peak health bodies including the World Health Organization (WHO) state that schools should be prioritised for reopening for face-to-face learning during the pandemic.^{20,21}

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The Role of Children and Adolescents in Transmission

The majority of children develop asymptomatic or mild disease and hospitalisation and death are rare.²² Transmission of the virus to vulnerable household members and teachers has been a concern around reopening schools. Household and seroprevalence studies show children are infected at lower^{23–29} or equal to adults.³⁰

Studies show children aged <5 years with mild or moderate COVID-19 had a high viral load, similar to adults, which suggests that young children could potentially be important drivers of SARS-CoV-2 transmission.^{31,32} However, being infected does not necessarily equate with having the ability to transmit the virus and it remains unclear how long children shed infectious virus.^{31,33} In another study, compared with adults, children with nasopharyngeal swabs that were SARS-CoV-2 positive were less likely to culture live virus compared with adults.³⁴ Age-related immunological differences in response to the infection may also explain the difference in severity of infection and infectivity rates^{35,36} including early activation of the innate immune system in children, allowing the virus to be cleared before it can replicate.³⁷ That said, evidence from school camp outbreaks³⁸ and India³⁹ suggest children transmit to a similar degree as adults, especially in settings that are crowded and where mitigation strategies are challenging.

Older adolescents, on the other hand, have similar or higher rates of infections, which is unsurprising, given their complex social and physical mixing patterns with their peers.⁴⁰ Whether biological age-related changes contribute to higher infectivity rates compared to younger children is unknown.

Regarding the risk to the household, a UK study of 9 million people aged <65 years and 2 million >65 years, household infection was not increased by living with children less than 12 years old and mildly increased while living with an adolescent aged 12–18 years.⁴¹ The study was repeated between 1 September 2000 and 12 December 2020, at the time of the second wave and showed a small increase in the risk of infection and hospitalisation in members of households with children and adolescents.⁴¹ In intergenerational households, as in India, index cases aged between 0–4 years were more likely to spread it amongst their own age group rather than to the elderly.³⁹ In Victoria, it was similarly very uncommon for the elderly to be linked to any infection from a school or ECEC.⁴²

Box 1 Lessons learnt from the Australian ECEC and school experience

- 1 COVID-19 cases increases in schools and early childhood settings when there is community transmission.
- 2 Australian data suggests that SARS-CoV-2 transmission within school settings is low and can be mitigated through COVID-19 safe practices and effective measures to test, contact trace and isolate.
- 3 School closures negatively impact the wellbeing, psychosocial aspects and education of students; have economic costs to families; and should be avoided wherever possible.

Box 2 Recommendations

- 1 ECEC and schools need to be seen as essential services and prioritised for staying open to guarantee equitable learning environments and lessen social and educational effects of school closure. Closing ECEC and schools should be a last resort, especially for ECEC and primary schools as children in these age groups are less likely to transmit and be associated with an outbreak.
- 2 A coordinated, consistent public health response (test, contact trace and isolate) is required to respond to a case attending a school/ECEC. In anticipation of virus re-introduction/outbreaks States' and Territories' school mitigation plans should be prepared in advance.
- 3 There should be a staged mitigation approach in school/ECEC proportionate to the local COVID-19 incidence rates.
- 4 The mental health and well-being of children should be monitored in schools with regular wellbeing surveys.
- 5 A cyclical review of the recommendations every 6–12 months depending on the Australian epidemic, new global evidence and vaccination programs.
- 6 ECEC and school staff should be prioritised for COVID-19 vaccines.

A critical observation regarding age groups most responsible for transmission comes from Israel, where high coverage of Pfizer/BioNTech mRNA vaccine in people aged >16 years has led to a decrease in rates of infection in non-vaccinated children and adolescents aged <16 years. It seems this vaccine may interrupt transmission in adults, which prevents infection in age groups too young to be vaccinated.⁴³

Transmission in School and ECECs

SARS-CoV-2 introductions into schools and ECECs will occur when there is virus circulating in the community. Transmission studies within schools and ECEC however have reassuringly shown that in the majority of settings, where public health mitigation strategies are in place, such as tracing and isolating close contacts, the secondary attack rates are low (Table 1).^{44–56, 90–92} An exception was an outbreak in an Israeli high school, which resulted in 178 secondary cases originating from 2 index cases.⁴⁴ Large class sizes of 30–35 students in small poorly ventilated classroom settings were likely contributing factors to spread. However, this single outbreak did not have substantial impact on community transmission, and there was no increase in COVID-19-related hospitalisations and deaths after schools reopened.⁵⁷

The health of school staff also needs consideration. However, the evidence available is mixed, which makes assessing their level of risk challenging. Transmission within the school or ECEC occurs most commonly between staff members or high school students. A survey of 57 335 childcare workers²⁵ in the USA found no difference in the rates of COVID-19 among those who worked or did not work during the pandemic.⁵⁸ Educators working in home daycare reported a higher risk of COVID-19, perhaps as these settings mimic conditions seen in household settings, which have been associated with transmission rates ranging from

Table 1 Outbreak investigations of SARS-CoV-2 in schools and ECECs outside Australia

Educational facility	Location	Period (2020)	Community incidence rate ⁹⁰⁻⁹²	Mitigation strategies	Findings
<i>ECECs</i>					
	Rhode Island, USA ⁴⁶	1 Jun–31 Jul	271/100 000	Masks for adults, daily symptom screening, enhanced cleaning and disinfection	52 cases (30 students, 20 staff, 2 parents), in 29 ECECs In 20 (69%) settings no transmission occurred, secondary transmission likely occurred in 4 (7%) settings, one of which had poor compliance to implemented mitigation strategies
	Salt Lake City, USA ⁴⁷	1 Apr–10 Jul	860/100 000 (Utah)	Mask use in adults, hand hygiene, frequent cleaning/disinfection of high touch surfaces	17 ECECs had an outbreak† 3 outbreaks described: primary cases were all staff 19 secondary cases: (7 staff members, 12 students); 1 ECEC had 14 secondary cases)
<i>Schools</i>					
	Israel ⁴⁴	May 2020	63/100 000	Daily health reports, hygiene, facemasks, social distancing and minimal interaction between classes	2 index cases 178 secondary cases Large class sizes of 30–35 students in small poorly ventilated classroom settings were likely contributing factors to spread
	Ireland ⁴⁸	1 Mar–13 Mar	2/100 000	No mitigation strategies	6 cases (3 students and 3 adults) attended 6 schools. No secondary cases
	South Korea ⁴⁹	20 May–11 Jul	1/100 000	Universal mask use, plastic barriers between desks, increased hand hygiene	44 student cases in 38 schools More than 13 000 students and staff were tested Transmission only occurred in 1 primary school setting (2 secondary cases)
	Italy ⁵⁰	14 Sep–5th Oct	64/100 000	Mask use, hand hygiene, physical distancing	1350 COVID-19 primary cases (1059 students, 145 teachers, 146 other staff members) attended 1212 schools No secondary cases in 90% of settings Only 1 high school had a cluster of more than 10 cases.
	Germany ⁵¹	28 Jan–31 Aug	295/100 000	Hygiene measures, staggering timetables, restricting class sizes, face masks, physical distancing	48 outbreaks† described 2 high schools had >10 cases
	Norway ⁴⁵	28 Aug–11 Nov	299/100 000	Hygiene measures, physical distancing,	13 primary student cases (8 aged between 5–10 years and 5 aged 11–13 years) Total 292 school contacts There were 3 secondary cases (2 students and 1 adult)
	Finland ⁵² (Helsinki)	Mar 2020	26/100 000	None specified	2 primary cases (1 student and 1 adult) 184 contacts; 140 tested 7 secondary cases (all from staff primary case)

(Continues)

Table 1 (Continued)

Educational facility	Location	Period (2020)	Community incidence rate ⁹⁰⁻⁹²	Mitigation strategies	Findings
	New York City ⁵³	9 Oct–18 Dec	4178/100 000	Screening, mask use, distancing of desks, reduced class sizes	2221 primary cases (889 students, 1342 staff) 36, 423 contacts 191 secondary cases
<i>Both ECECs and schools</i>					
	England ⁵⁴	1 Jun–17 Jul	54/100 000 (UK)	Cohorting of students into groups	928 000 recommenced face to face learning 177 settings with COVID-19 case 122 settings with no further transmission Transmission occurred most often between adult staff members
	Italy (Reggio Emilia province) ⁵⁵	(1 Sep–15 Oct)	154/100 000 (Emilia Romagna)	Mandatory mask use in secondary school settings, physical distancing of desks in schools, mixing of classes minimised	43 primary cases (38 students, 5 teachers) in 36 settings (8 ECEC, 10 primary, 18 secondary schools). 39 secondary cases in 13 schools. Attack rate in secondary schools (6.64%) higher than primary schools (0.44%)
	Singapore ⁵⁶	1 Feb–30 Mar	16/100 000	Cohorting of students into groups, staggered recess breaks, suspension of extracurricular activities	3 cases (2 students and 1 staff) in 1 high school and 2 childcare settings Transmission occurred between 16 staff members in an ECEC No students tested positive

†Outbreak defined as 2 or more confirmed COVID-19 cases within a setting. The studies from Salt Lake City and Germany limited their analysis to outbreak settings with 2 or more cases and thus described attack rates are likely to be grossly overestimated for the population. [Correction added on 12 July 2021, after first online publication: In the third row, 'School, Israel' of the third column, 'Period (2020)', 'Mar 2020' has been amended to 'May 2020'.]

0.7 to 37.8%.²⁵ Studies from Sweden,⁵⁹ Scotland,⁶⁰ UK⁶¹ and Norway⁶² comparing rates of COVID-19 and hospitalisation suggest that teachers did not have a higher rate of COVID-19 infection compared to the community. A French study of 22 ECEC showed that childcare staff had comparable seropositivity rates to health-care workers and double the rate to that of preschool children. Importantly, there was no increase in the risk of school or ECEC staff contracting SARS-CoV-2 following exposure to a child with COVID-19. Both children and adult staff were more likely to be seropositive if they had a positive confirmed case in a household member.⁶³

Role of ECEC and Schools in Community Transmission

School closure prevents the introductions of SARS-CoV-2 into schools, but there is less evidence, beyond modelling studies,⁶⁴ that school closure has a dampening effect on community transmission. Moreover, in 2020, many European countries such as Iceland,⁶⁵ England⁶⁶ and Spain⁶⁷ have been able to drive down their rate of community transmission while keeping schools open. Ireland was still able to keep schools open between October and December 2020 despite enforcing a hard lockdown.⁶⁸ In England, SARS-CoV-2 rates had started to increase from August, initially in young adults, followed by younger age groups, prior to school reopening.

In November 2020, a national lockdown was implemented whilst keeping schools open and was associated with rapid declines in SARS-CoV-2 infection rates.⁶⁶ In both settings, an upsurge in cases during the December–January holiday period delayed school reopening. The European Centre of Disease Control (ECDC) conducted a review up to March 2021 and found that the return to school by children around mid-August 2020 did not appear to have driven the upsurge in cases from October 2020.⁶⁹

The Australian Perspective

Evidence from two large studies in New South Wales (NSW) and Victoria during 2020 has demonstrated that the number of cases identified in individuals attending schools and ECEC settings is proportionate to the rate and geographic location of community transmission.

NSW (population 8.1 million; 1.8 million aged 18 years or younger)⁷⁰ had had the highest rate of disease notifications (34/100000) during the first of four school terms, Term 1 (25 January to 10 April) 2020. A prospective study conducted throughout 2020 in all educational facilities in this state found that during Term 1, 12 students and 15 staff members who had COVID-19 attended 15 schools and 10 ECECs while infectious. Of 1448 close contacts, the secondary transmission rate was only 1.2%, with 633 (43.7%) of close contacts tested.⁷¹

Term 2 saw a near absence of community transmission and only six schools/ECECs had a primary case and no secondary transmission.⁷²

In Term 3 (21 July to 25 September), while community transmission (10/100000) occurred at a low rate, it was associated with more primary cases in educational settings (32 students, 7 staff members and 3821 close contacts in 34 settings) than in Term 1. The cases mainly occurred in areas of increased community transmission. Secondary transmission rates were comparable to (0.9%) Term 1, and highly valid, noting close contact testing rates (using nucleic acid testing and serology) were 95%.⁷³

In Term 4 (26 September to 18 December), there were 10 primary cases (1 staff member and 9 students), with contact testing rate of 98.7% and secondary transmission rate of 1.2%.⁷⁴ Overall, transmission in primary schools/ECECs with a child primary case was 0.4% and in a high school with a child primary case 0.9%; transmission in any setting with a staff primary case was 1.7%.^{72–75}

Victoria (population 6.6 million; 1.5 million aged 18 years or younger)⁷⁰ experienced the greatest number of SARS-CoV-2 cases in Australia with 19 109 COVID-19 infections identified over 2 separate waves between 25 January and 23 November August 2020.⁷⁶ Schools and ECECs were mostly closed for face-to-face learning during this period but remained open for children of essential workers throughout. The main reason for closure was to restrict the movement of adults to prevent adult-adult transmission.

A retrospective study between 25 January and 31 August identified 1635 infections linked with schools and ECECs.⁴² Introduction of cases occurred in local government areas with the highest number of community cases but there was limited onward transmission within these schools/ECECs. When infections occurred in schools, outbreaks were uncommon, with 67% of events involving a single case in a staff member or student. When outbreaks did occur, most were small with 92% of events involved 10 cases or less. Primary cases involving young children were less likely to progress to an outbreak (defined as two or more cases) compared with older adolescents and staff. If the primary case was aged 0–5 years, 14.1% of ECECs recorded additional cases, compared to 30.5% (6–12 years), 33.3% (13–15 years), 42.9% (16–18 years) in older children. Transmission occurred in 39.1% of settings when the first case was a staff member.⁴² The rapid public health response of testing, tracing and isolation of cases, is likely to have contributed to this lack of onward transmission.

In Western Australia, there have been <5 cases of community transmission since 13 April 2020 due to effective public health mitigation strategies and strict border closures. A program to swab asymptomatic students and staff attending schools was instituted to reassure the public throughout school Terms 2 and 3 (29 April–25 September). Of 13 988 swabs collected in 40 schools across three rounds of testing, there were no cases of SARS-CoV-2 infection detected and planned transmission studies were not activated.⁷⁷ Fear of community spread from a single community case in early 2021 led to a lockdown which included a 1-week delay in restarting school.

School Mitigation Measures and Do they Work?

Three broad intervention strategies are required to maintain face-to-face learning: organisational, structural/environmental and

surveillance and response.⁷⁸ Public Health England surveillance found that wider public health mitigation strategies and access to early universal viral testing resulted in a decrease in outbreaks within school and ECEC settings.⁷⁹ Strategies such as wearing masks, staying home if sick and student cohorting have been effective measures in reopening US schools.⁸⁰ In Europe's second wave, school closures were shown to have a lesser effect on reducing SARS-CoV-2 transmission than during the first wave, with safer operation of schools possible if strict safety measures such as symptom screening, sanitisation, adequate classroom ventilation and reducing group sizes were adopted.⁸¹ Together with COVID-19 safe practices, key to keeping schools and ECECs open has been outbreak control through free and timely access to viral testing and a public health system capable of tracing and isolating close contacts.^{30,71}

SARS-CoV-2 Variants

Since September 2020, there have been SARS-CoV-2 variants with higher transmissibility (B.1.1.7, B135, P1) circulating globally.⁸² Early data on B.1.1.7 from a January 2021 Public Health England report⁸³ suggest that children do not have a higher infection rate than other age groups. More so, children under the age of 10 years are half as likely to transmit the variant virus compared to adults. Transmissibility of the variant virus in educational settings is yet to be determined.

What Should Australian ECEC and Schools Be Doing Now?

Introductions of the virus into schools and ECECs will occur until elimination has been achieved. With the impact of school closure on students wellbeing and health, including broad psychosocial and educational impacts,^{84,85} well established alongside the growing data that children and schools are not key drivers of infection, keeping schools and ECECs open must remain a critical factor during further outbreaks.^{42,86,87} Australia's ability to control community transmission of SARS-CoV-2 has been impressive, and our ongoing work in schools and ECECs has been pivotal to understanding transmission of SARS-CoV-2 in these settings. We have shown that we can suppress outbreaks even with schools remaining open by implementing strict public health strategies (Box 1).

Several Australian states have closed schools as part of their 5-day circuit breaker lockdown. The concept of the 'Precautionary Principle'⁸⁸ is relevant here and while it is important to be vigilant and have the ability to interrupt community transmission, especially when we have SARS-CoV-2 variants being introduced into Australia, it is vital that we regard schools as essential services, anticipate these events and be pandemic ready. We need to act in accordance with jurisdictional health and education guidelines⁸⁹ that can be scaled up and down dependent on rates of community transmission, avoiding hasty closures. This is what was recommended in Victoria.⁴²

Keeping schools open also means maintaining capacity for widespread testing and the ability for public health officials to respond to school cases. To do this, we recommend that all Australian States and Territories institute a national strategy and

commitment to keeping schools open with agreed systems and adequate funding in place to measure its effectiveness (Box 2), especially in the setting of emerging SARS-CoV-2 variants. Teachers and school staff should also be prioritised for COVID vaccines, especially in settings with higher incidence of COVID-19. Our kids depend on it.

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Conflict of Interest

None declared.

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