

# Poorly ventilated schools spread delta variant

August 18 2021, by Geoff Hanmer, Bruce Milthorpe

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Credit: AI-generated image ([disclaimer](#))

Infections of the Delta strain are increasing across Australia. A [significant number of recent outbreaks](#) have been in schools.

In the earlier waves of the COVID outbreak, in 2020, evidence showed children were getting COVID at much lower rates than adults, and the advice from experts was to keep schools open. But a [series of papers later showed](#) children were at similar risk of infection to adults.

This is even worse with Delta. According to the [US Centers for Disease Control](#), the Delta variant is about twice as infectious as the earlier strains. And [preliminary data](#) suggest children and adolescents are at greater risk of becoming infected with this variant, and transmitting it.

The [World Health Organization](#) has recognized SARS-CoV-2, the virus that causes COVID-19, is airborne. The evidence for aerosol transmission is now enough for the Australian Infection Control Expert Group (ICEG), which advises the [federal government](#), to have [recently amended](#) its earlier advice that COVID-19 was only spread by contact and droplets:

"ICEG has also recognized broader circumstances in which there may be potential for aerosol transmission [...] ICEG [...] notes the risk may be higher under certain conditions, such as poorly ventilated indoor crowded environments."

"Poorly ventilated indoor crowded environments" accurately describes conditions at many schools. Even in lockdown, schools are still open for children of essential workers and classrooms in use can have relatively high occupancy.

In or out of lockdown, poorly ventilated schools are a super-spreader event waiting to happen.

## **How are schools ventilated?**

Most schools are naturally ventilated. This means windows must be open to deliver fresh air which will dilute and disperse airborne pathogens.

It is not a coincidence the current Australian outbreaks are happening in winter, when naturally ventilated buildings, including most schools, are more likely to have their windows shut to keep the heat in.

Some schools, particularly those with open learning spaces, have buildings too deep for [natural ventilation](#) and are mechanically ventilated. This may involve [air conditioning](#), but not all air conditioning includes ventilation. For instance, a split system air conditioner typically recirculates air inside a space whereas ventilation introduces fresh air into the [building](#).

Mechanically ventilated buildings are [supposed to have around](#) 10 liters per second (l/s) of fresh air per person. But the temptation to throttle back fresh air to save energy and money is ever present. And even with 10 l/s per person coming in, there may be places with poor ventilation. This includes stairwells, lifts, corridors and assembly spaces.



This measurement of a classroom in an older-built school shows safe CO<sub>2</sub> levels.  
Author provided

As [aerosols may persist in the air for hours](#), schools with poor ventilation become a high risk for transmission and kids can take it back to their families.

We have been measuring ventilation in schools and other buildings in Sydney, Canberra, Brisbane and Adelaide using a carbon dioxide (CO<sub>2</sub>) meter. This is because CO<sub>2</sub>, which is exhaled by humans, is a good proxy for the level of ventilation in a space.

Outside air is about 400–415 ppm (parts per million) of CO<sub>2</sub> and well-ventilated indoor environments are typically below 800 ppm with best practice around 600 ppm.

Our informal measurements show many newer mechanically ventilated buildings are not well ventilated. Perhaps counter-intuitively, older style naturally ventilated [school](#) buildings with leaky wooden windows on both sides of the room and high ceilings often appear to perform well.

Just looking at a building is not a reliable guide to how well ventilated it is.

## **What schools need to do**

We can do several things to ensure schools are well ventilated. The first is to ensure the school has access to a CO<sub>2</sub> meter and takes action where CO<sub>2</sub> is above 800 ppm.

If the building has windows and doors, open them. This may require kids and teachers putting on an extra layer of clothing, turning up the heating, providing supplementary heaters and making revised security arrangements.

Anything required to keep people safe and thermally comfortable in a well ventilated space is likely to be much cheaper than dealing with an outbreak.

Serviceable standalone [NDIR sensor-type CO<sub>2</sub> meters](#) can be bought online for less than A\$100. More sophisticated networkable devices are available for under A\$500.

If the space is mechanically ventilated, a school will need to get a mechanical engineer to work out how the system can be improved. In the meantime, staff could try opening doors, using fans to mix air in large volume spaces or move activities outside.

I have been recording lectures for the last year in a small basement storage room (it's quiet). By the end of a session, I feel pretty drained. That's probably inherent to lecture recording, but surely this isn't helping... [@CO2Guerrillas](#) [@citlanx](#)  
[pic.twitter.com/gCU9I17E4f](https://pic.twitter.com/gCU9I17E4f)

— Aaron Miller (@amillerphd) [January 22, 2021](#)

Where improvements in ventilation are not immediately possible, portable air purifiers can reduce the amount of virus in the air. An air purifier will need at least a [HEPA \(high-efficiency particulate absorbing\) filter](#) to be effective and has to be matched to the size of the room. A typical classroom may need two devices to work and a large open plan space may need several.

In future, we will need to change building regulations to deliver safe, clean air in schools. For now, we just need to do the best we can. It may be as simple as opening the windows.

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