

# High levels of CO<sub>2</sub> found in small study of early childhood centres: Improving ventilation in the time of COVID-19

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## Summary

Good ventilation is considered to be an important way to reduce the transmission of respiratory viruses in indoor spaces where people gather and spend time.<sup>1</sup>

In this study run by medical students, the CO<sub>2</sub> levels were measured in six randomly chosen early childhood centres in northern Taranaki during June and July 2022. High levels of CO<sub>2</sub> (over 1,500ppm) were found in four out of the six early childhood education centres (ECE).

While schools throughout Aotearoa New Zealand have been supplied with CO<sub>2</sub> monitors, ECEs have not despite being known to have high levels of respiratory virus transmission at times.

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Aotearoa New Zealand, alongside many other developing countries, has seen a dramatic

increase of children in early childhood education (ECE) environments in recent years<sup>2</sup>. Over 68% of children at two years of age are currently in some sort of formal care, with that figure up to 84% at age four<sup>2</sup>.

Respiratory viruses and the respiratory infections caused by them are unfortunately part of the daily life of children attending early childhood education<sup>3</sup>. There have also been high levels of Covid-19 infection and hospitalisation rates in this age group<sup>4</sup>. Children under five years are currently not vaccinated against Covid-19<sup>5</sup> and are too young to wear masks.

### **Monitoring CO<sub>2</sub> in early childhood centres**

The purpose of this research was to assess the levels of carbon dioxide (CO<sub>2</sub>) in a sample of early childhood education centres to determine ventilation levels and the risk of respiratory virus transmission. Six randomly chosen ECE centres from a total of 55 centres in New Plymouth and Waitara were involved in an observational study during June and July 2022. The ECE centres were initially contacted by phone and a letter was emailed to formally invite them to participate in the study. All six centres confirmed they were willing to be involved in the study.

CO<sub>2</sub> levels in both activity rooms and sleep rooms were measured using an Aranet4 monitor for a minimum of four days. Good ventilation was defined as less than 800 parts per million (ppm) and 1,500 parts per million of CO<sub>2</sub> was defined as high.

It was found that ventilation levels were not optimal at times in four out of six facilities. Four out of seven sleep rooms, three out of five smaller activity rooms (<150m<sup>3</sup>) and two out of five larger activity rooms (>150m<sup>3</sup> in area) reached levels of CO<sub>2</sub> more than 1,500ppm. (See Charts One, Two and Three in the Appendix.) The number of children per room with CO<sub>2</sub> levels above 1500ppm varied from 5-15 children in the sleep rooms, 10-20 children in the smaller activity rooms and 10-25 children in the larger activity rooms. Two out of the four sleep rooms with high CO<sub>2</sub> levels did not have windows able to be opened but all the rest of the rooms either had windows or sliding doors that could be opened. None of the monitored rooms exceeded 3000ppm at any time.

It is likely that poor ventilation is a feature for many ECE centres all around New Zealand. The findings in this study in Taranaki are consistent with what has been found in similar studies undertaken in schools<sup>6</sup>, and in ECE centres in Auckland<sup>7</sup>. Utilising CO<sub>2</sub> monitors in spaces such as sleep rooms could provide practical help to ECE centres with their ventilation status.

All ECE centres involved in this study showed great interest in the results and what actions they could take to make the children's environments healthier. This is especially important with the potential of future Covid-19 variants. Reducing CO<sub>2</sub> levels in an educational environment has other benefits as well. High levels are linked to poor concentration, impaired cognitive performance, and higher rates of absenteeism<sup>8,9</sup>. The results of ventilation monitoring have applications to both the children at the centre and also for the health and well-being of staff and helpers.

This small project has shown that shown that CO<sub>2</sub> monitors can better identify a space's ventilation status and thus could play a role in reducing respiratory virus transmission. An article published in 2022 looked at the pros and cons of CO<sub>2</sub> monitors and discussed the need of raising public awareness around the importance of ventilation. It was concluded

that while CO<sub>2</sub> monitors only give information on one of the factors related to disease transmission they at least help “make an invisible problem visible”<sup>10</sup>.

Two main recommendations are made:

1. Free CO<sub>2</sub> monitors should be supplied by the Ministry of Education to all ECE centres before winter 2023 in the same way they were provided to all state and state-integrated schools in 2022. They are relatively cheap (about \$380- \$450 per unit) and are currently the only effective way of measuring ventilation.
2. Public Health Services around the country consider setting up “lending libraries” with CO<sub>2</sub> monitors to allow for groups and organisations with an interest in health and well-being to evaluate their usefulness over a period of a few weeks. This may motivate these organisations to then buy such monitors for themselves and improve ventilation in their premises.

## What is new in this Briefing

- This small ventilation study measured the CO<sub>2</sub> levels in six randomly chosen early childhood centres in northern Taranaki during June and July 2022.
- It found high levels of CO<sub>2</sub> (over 1,500ppm) in four out of the six early childhood education centres (ECEs) – indicative of poor ventilation.

## Implications for public health practice and policy

- Free CO<sub>2</sub> monitors should be supplied by the Ministry of Education to all ECEs before winter 2023.
- Public Health Services around the country could consider setting up “lending libraries” with CO<sub>2</sub> monitors to allow for groups and organisations with an interest in health and well-being to evaluate their usefulness over a period of a few weeks. This may motivate these organisations to then buy such monitors for themselves and improve ventilation in their premises.

### Author details:

Jaimee Paterson, Grace George and Sam George were 6<sup>th</sup> year medical students (trainee interns) on a public health elective from the University of Otago at the time the study was undertaken.

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### Appendices

Chart One. Four Day Overview for Sleep Rooms

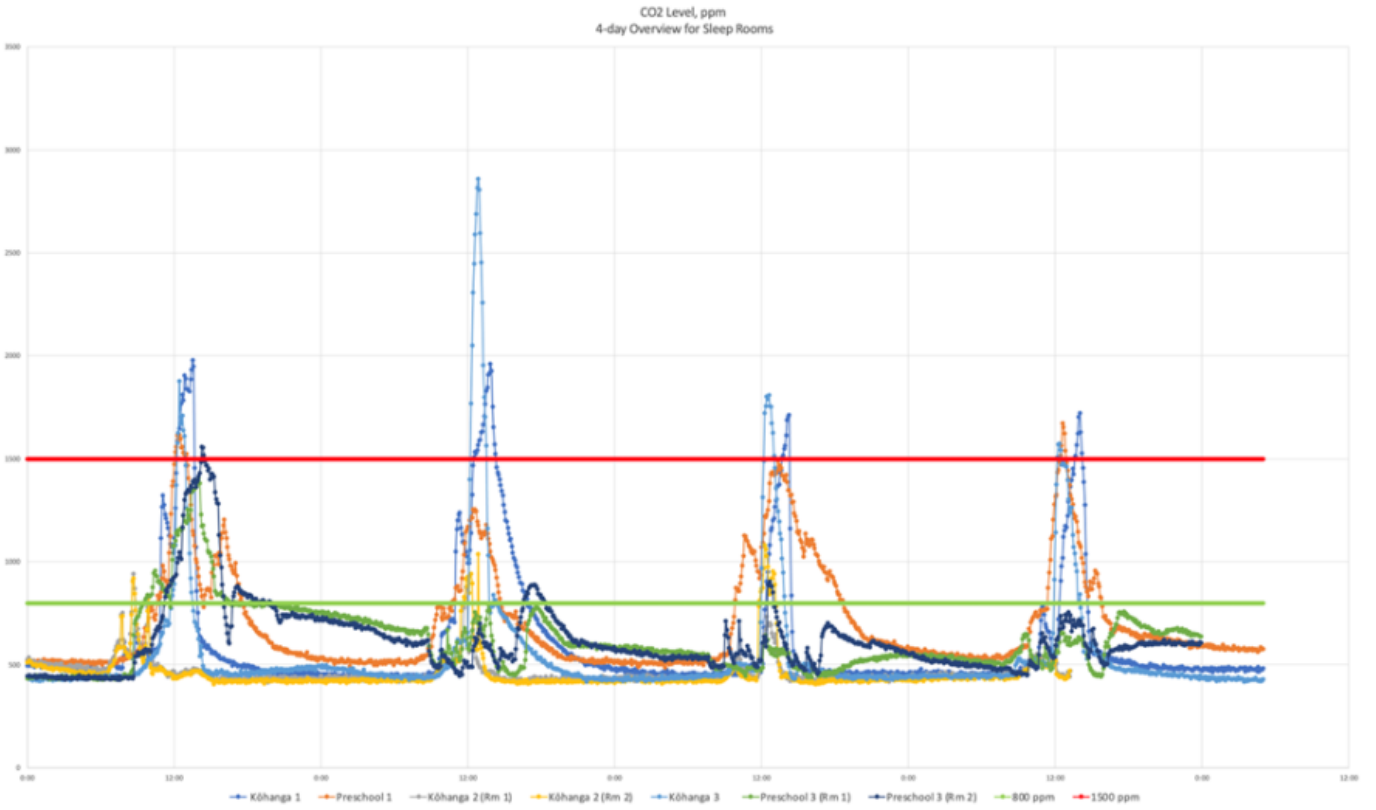


Chart Two. Four Day Overview for Smaller Activity Rooms

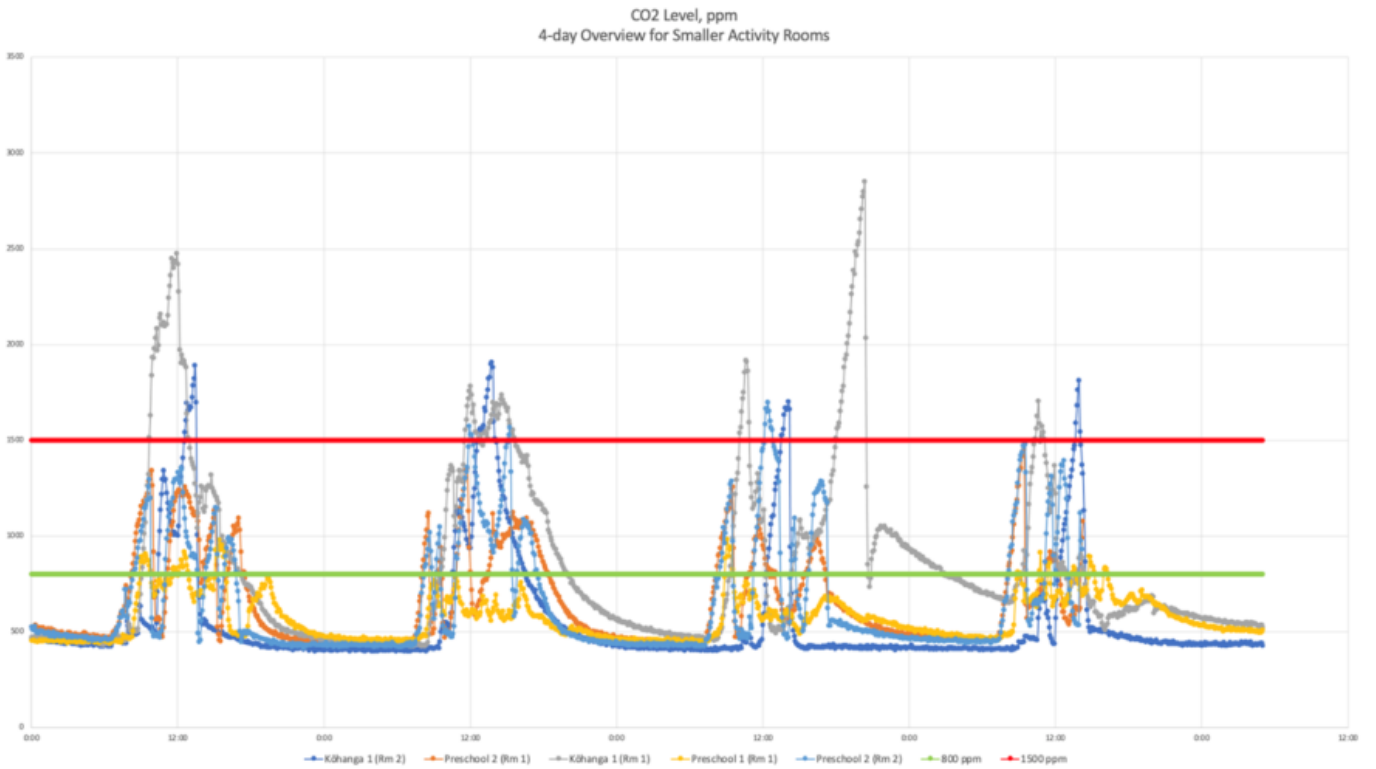
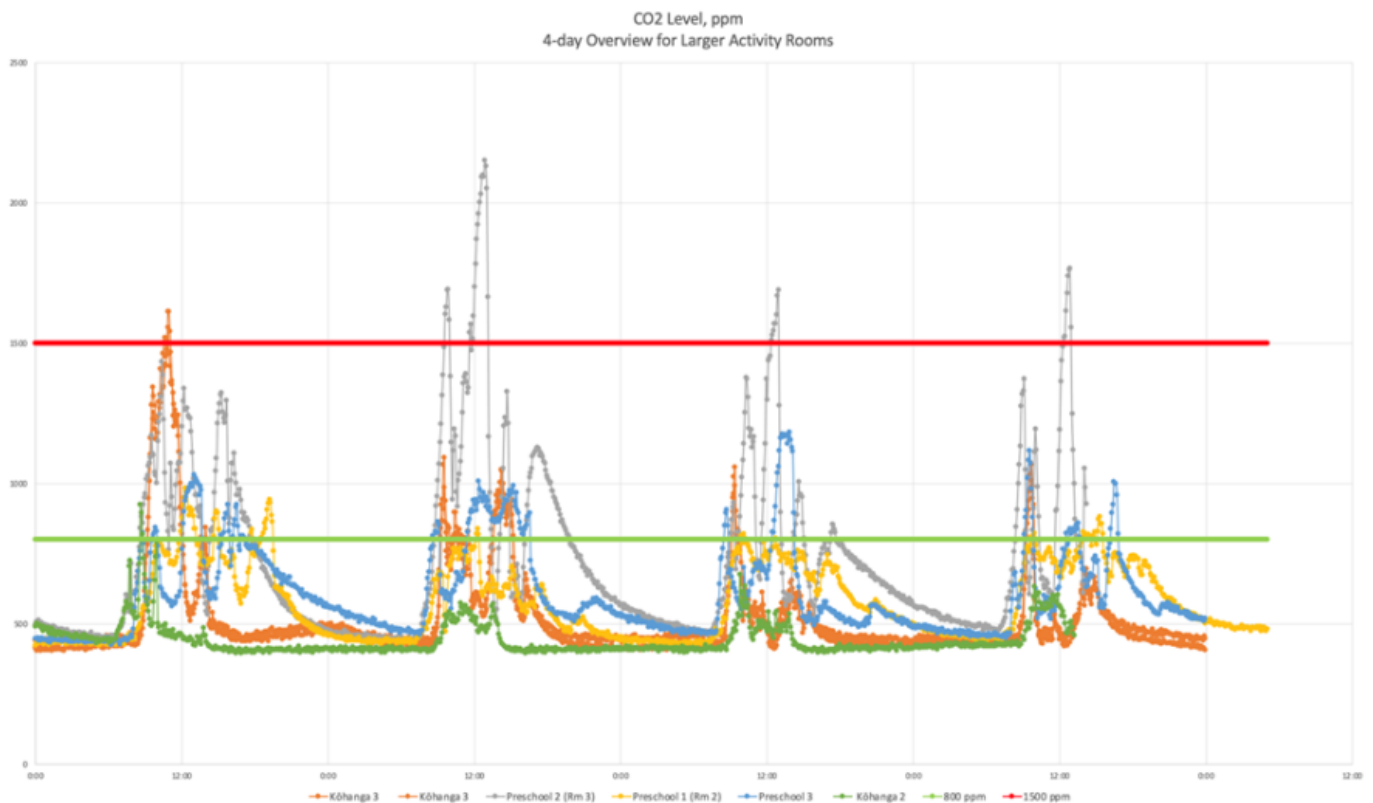


Chart Three. Four Day Overview for Larger Activity Rooms



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