BAY AREA // HEALTH

# COVID variants mean ventilation is more important than ever. So what does 'good' air flow look like?

Danielle Echeverria
July 14, 2022 | Updated: July 14, 2022 1:27 p.m.

School principal Diane Lau Yee (left) and delivery person Ronnie Wehr move air purifiers with medical grade HEPA technology into Robert Louis Stevenson Elementary School in San Francisco in September 2021.
Santiago Mejia/The Chronicle

As coronavirus variants like BA.5 and BA.2.75 become more prevalent and more transmissible, experts are repeatedly pointing to a transmission reduction strategy that's worked since the beginning of the pandemic — air ventilation, especially indoors.

"We don't know what variants we're dealing with in the future," said Stanford University infectious disease specialist Dr. Abraar Karan, "but transmission is always the same."

Because of that, he said, there "has to be a strategy of cleaning the air."

But what does good ventilation actually look like?

Ventilation is often measured in "air changes per hour," which measures how many times all of the air in a room is replaced, calculated using the ventilation rate and the volume of air in a room.

In other words, it's about cleaning the air that's there and getting fresh air in.

"Simply put, the more fresh, outside air inside a building, the better," Shelly Miller, a professor of mechanical engineering at the University of Colorado Boulder, wrote in the Conversation. "Bringing in this air dilutes any contaminant in a building, whether a virus or something else, and reduces the exposure of anyone inside."

But most home heating and cooling systems don't bring in outdoor air, according to the Environmental Protection Agency, which means outdoor air comes in through open windows and doors, as well as the cracks around them and any other openings.

So how many air changes per hour should you have?

The CDC recommends that modern health care facilities have a minimum of 12 air changes per hour to control spread in airborne infection isolation rooms, and more for other parts of the hospital.

Though these target numbers were made with medical facilities in mind, they "can provide a good reference for other workplaces and public settings" where people who have COVID or any other airborne disease may be present, according to the California Department of Public Health.

For common non-medical public spaces like offices and schools, experts say that at least six air changes per hour can help significantly with virus spread.

Twelve air changes per hour is "a great goal if you could try to get that," said Brent Stephens, an expert in indoor air quality and building science at Illinois Tech, during a webinar on air quality in schools. "If you could get six air changes per hour or if you can get five air changes per hour or something near that, I think those are still really quite reasonable risk reduction numbers."

While the air change rate is generally a good measure for typical public spaces like schools or offices, it's not always a good indicator of how much clean air is available.

For example, airplanes have such high air change rates — but it doesn't necessarily mean there's a lot of virus-free air, according to the American Society of Heating, Refrigerating and Air-Conditioning Engineers, which has for years worked on issues of ventilation.

That's because how densely an indoor space is occupied affects how much potential virus is in the air — the more people, the higher the risk.

"Aircraft cabin outdoor air changes per hour (ach) are indeed high—perhaps 15 ach for a narrow body aircraft and 13 ach for a wide body aircraft," the society's recent guidance on aircraft air quality said. "However, a high outdoor air change in the case of densely occupied spaces like an aircraft cabin or a subway car is not an indicator of a high supply of virus-free air to the occupants."

In these kinds of cases, experts said, layering strategies is important — so wearing a high quality mask on a plane, for example, on top of its high ventilation rate further reduces risk.

But many places — especially schools — are far from even six air changes per hour. So how can air quality be improved in these spaces?

Ronnie Wehr delivers air purifiers with medical grade HEPA technology to Robert Louis Stevenson Elementary School in San Francisco in September 2021. As coronavirus variants become more prevalent and more transmissible, experts are repeatedly pointing to indoor ventilation as a transmission reduction strategy.
Santiago Mejia/The Chronicle

When it's an option, opening windows and doors is a good start to increasing ventilation, experts said. For optimal air flow, windows should be open across the room from each other if possible. Placing a box fan in a window blowing out can also help, Miller wrote.

For buildings with HVAC systems, building managers can set the system to bring in as much air as possible. HVAC systems should be equipped with a MERV 13 or greater filter, which should be cleaned as needed for both COVID-19 and for outdoor pollutants like wildfire smoke, according to the state health department.

Another more temporary solution is assembling a low-cost, homemade air cleaner with a box fan and air filters known widely as the Corsi-Rosenthal Box — Corsi was one of the inventors — which can be just as effective as a HEPA filter.

The California Air Resources Board also has a list of certified air cleaners, though not all use a HEPA filtration system.

These portable filters can help even in the case of buildings with a good HVAC system.

"Even in the case of a well-maintained HVAC system running at full capacity (providing 5 to 7 ACH), portable filters in the room bringing the total ACH to 10 or more provide a significant improvement in infection risk reduction," a Johns Hopkins report on school ventilation said.

But if you don't know whether a room has good ventilation and you can't control it, use your instinct.

"If you walk into a building and it feels hot, stuffy and crowded, chances are that there is not enough ventilation," Miller wrote. "Turn around and leave."