

Why the Air at the Gym May Be More Likely to Spread Covid

A new study found exercisers expel a shocking number of tiny aerosol particles when they are working hard.

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Many gyms and health clubs seem to be filling up again with people eager to return to their old routines and communities or get in shape for summer, at the same time that new Omicron variants are pushing Covid infections up. So, how safe is it to go back to the gym?

Put another way, how many microscopic aerosol particles are the other cyclists in your spin class breathing out into the room? How many is the runner on the nearby treadmill spewing forth? A small study about respiration and exercise published Monday in the Proceedings of the National Academy of Sciences provides some rather startling answers.

The study looked at the number of aerosol particles 16 people exhaled at rest and during workouts. These tiny bits of airborne matter — measuring barely a few hundred micrometers in diameter, or about the width of a strand of hair, and suspended in mist from our lungs — can transmit coronavirus if someone is infected, ferrying the virus lightly through the air from one pair of lungs to another.

The study found that, at rest, the men and women breathed out about 500 particles per minute. But when they exercised, that total soared 132-fold, topping out above 76,000 particles per minute, on average, during the most strenuous exertion.

These findings help explain why several notable Covid super-spreader events since 2020 have occurred at indoor gym classes. They also could renew some people's concerns about indoor gym programs as Covid-19 cases increase again in much of the nation and raise questions about how to best reduce risks of exposure when we work out.

In general, packing hard-breathing bodies into enclosed spaces is a bad way to avoid

transmission of Covid-19 or other respiratory diseases. In 2020, 54 South Koreans developed Covid after Zumba classes with infected instructors and then passed it to family members and acquaintances. Later that year, all 10 members of a spin class in Hawaii taught by an infected instructor tested positive afterward, as did another 11 who came into close contact with one of the class members, a personal trainer and kickboxing instructor.

Scientists investigating these and similar outbreaks speculated that inadequate ventilation and high respiration rates among the exercisers contributed to the wildfire-like spread of Covid at the affected gyms. But the scientists could only guess about the extent to which exercise had increased the levels of aerosol particles in the gym areas. Accurately measuring the rise in floating particles during exercise is difficult.

So, for the new study, a group of exercise scientists and fluid dynamics researchers in Germany devised a novel way to measure aerosol emission, using a single stationary bicycle and rider inside an airtight tent. The cyclists wore silicone masks that captured their exhaled breaths, sending the air through tubes to a machine that counted each particle as it passed.

The researchers first measured people's particle production as they sat still and then as they rode at an increasingly punishing pace, until they were too exhausted to continue. Particles were counted constantly.

The scientists expected the exercisers' aerosol output to grow, as intensity ramped up. We all breathe deeper and faster as we work out harder. But the extent of the increase "surprised us," said Henning Wackerhage, a professor of exercise biology at the Technical University of Munich and a senior author of the new study.

The rise in aerosol emissions began moderately as riders warmed up and started pedaling harder. But as they reached a threshold at which their exercise became noticeably more strenuous — about when a jog becomes a run or a spin class switches into intervals — the rise in emissions became exponential. The riders started huffing out about 10 times as much air per minute as at rest, while the numbers of particles per minute soared more than 100 fold as riders approached exhaustion (with considerable variation from person to person).

In a room filled with spin-bike riders, treadmill runners or boot campers, "the aerosol particle concentration would increase a lot," said Benedikt Mutsch, a graduate student at the Institute for Fluid Mechanics and Aerodynamics at the University of the German Armed Forces in Munich and study co-author. The more particles, the more possibility of Covid-19 infection, if any exercisers are infected.

"The study provides mechanistic data to back up the assumption that exercising indoors is a higher-risk activity when it comes to transmission of Covid-19" than taking

your exercise outside, said Linsey Marr, a professor of civil and environmental engineering at Virginia Tech and expert on airborne transmission of viruses.

But these risks can be mitigated. “Good ventilation and air exchange are a great way to reduce transmission risk,” said Chris Cappa, a professor of civil and environmental engineering at the University of California, Davis, and expert in airflow dynamics.

“Open windows, especially with fans, can often be as effective as active ventilation systems,” he said. If windows at your gym are closed, ask the manager to fling them wide and crank up the fans. If the weather is stifling and air conditioning necessary, make sure your gym’s units draw air from outside, so fresh supplies replace the air filled with aerosol emissions from you and your classmates.

You might also suggest the gym install in-room air filters in each workout area, Dr. Cappa said. “These can be really effective in reducing transmission risk by removing the virus from the air.” They can be purchased commercially or even made at home, he said.

Also, stay well away from other exercisers. “Social distancing of six feet or more is always important,” Mr. Mutsch said. But it may not be enough during strenuous, indoor exercise classes. The new study did not track where cyclists’ aerosol particles flowed, but it is likely they stream well beyond six feet, he said. So, keep at least eight to 10 feet apart during strenuous workouts, which requires large rooms and small classes.

The classes themselves should likewise be well spaced. “If there are back-to-back exercise classes, some of the air from that first class will carry over to the second,” Dr. Cappa said. Be sure there are breaks of at least 15 and preferably 30 minutes between sessions, to allow the air to clear.

Mask up, as well. “Respiratory face masks reduce aerosol emissions,” Dr. Wackerhage said.

If you find a tight N95 mask uncomfortable during intense exercise, “I’d suggest wearing a good surgical mask,” Dr. Cappa said, which may feel slightly less constricting and steamy.

Finally, check the incidence of Covid-19 in your area. “The higher the local case rates,” Dr. Cappa said, “the more likely it is that an infectious person might be in the class with you.” If rates are rising, perhaps cycle — or jog or walk or stroll — outside until cases decline.

But keep moving. This study “is more incentive to ensure great ventilation and no crowding in gyms,” Dr. Marr said. But it is not a reason to skip workouts. “There are so many benefits to exercise,” she said, “that I’ll keep doing it in my well-ventilated, uncrowded gym.”

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