Staying 6 Feet Apart Often Isn’t Enough During COVID-19 Pandemic

Researchers say people can’t just rely on staying six-feet apart to stop the spread of COVID-19. Getty Images

- To reduce your risk of contracting COVID-19, public health experts recommend staying 6 feet away from people outside your “bubble,” but experts say that isn’t always enough.
- The 6-foot rule dates back to the late 1800s, when a German scientist found that pathogens were present in large droplets expelled from the nose and mouth.
- However, wind and weather can affect how droplets travel. If the humidity is low, bigger droplets can shrink and stay in the air longer.

All data and statistics are based on publicly available data at the time of publication. Some information may be out of date. Visit our coronavirus hub and follow our live updates page for the most recent information on the COVID-19 pandemic.

Wherever you go in public these days, signs, barricades, and stickers remind you to stay at least 6 feet away from other people in order to reduce the spread of the coronavirus that causes COVID-19.

This is physical distancing, also known as social distancing, and is a key public health tool for ending the COVID-19 pandemic.

Unfortunately, says Lydia Bourouiba, PhD, director of the Fluid Dynamics of Disease Transmission Laboratory at MIT, the 6-foot rule is based on outdated science.

She and her colleagues write in a new paper published Tuesday in the medical journal BMJ

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that there are many situations where 6 feet isn't enough to keep your risk low.

Origin of the 6-foot rule

The 6-foot rule dates back to the late 1800s, when German scientist Carl Flügge found that pathogens were present in large droplets expelled from the nose and mouth. Most of these droplets fell to the ground within 3 to 6 feet of the person with an infection.

In the 1940s, advances in photography enabled researchers to capture images of these expiratory droplets being sprayed when a person sneezed, coughed, or talked.

Other studies around that time found that large particles quickly fell to the ground near the person expelling them, reinforcing the 6-foot rule — in spite of limitations of the accuracy of these early studies.

These studies tended to group expiratory droplets into two categories: large and small. Scientists thought large droplets would fall quickly to the ground and small droplets would evaporate before they got very far, unless pushed by another airflow.

However, “in the last 90 years, we’ve learned a lot more about what is actually going on … when you speak or cough or sneeze,” said Jesse Capecelatro, PhD, an assistant professor of mechanical engineering at the University of Michigan in Ann Arbor, who wasn’t involved in the new study.

He says many factors can affect how far droplets are spread. If the humidity is low, bigger droplets can shrink and stay in the air longer. Wind outside or ventilation inside can also carry droplets farther away.

“This whole idea that there’s this 6-foot perimeter, and if you’re one inch beyond it then you’re safe, really doesn’t make much sense,” said Capecelatro.

In a recent systematic review, 8 of 10 studies reviewed found that expiratory droplets could travel more than 6 feet away from those with infections, and in some cases up to 26 feet.

Research with the coronavirus that causes COVID-19 supports the idea that 6 feet may not always be enough. In one study, researchers found the transmission distance of the virus may be up to 13 feet. In another, they detected it on multiple air vents

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in a patient's room.

There is also the case of the choir practice

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in Washington state in March, where one person with COVID-19 symptoms transmitted the virus to at least 32 other singers. The forcefulness of the exhalation while singing is thought to have helped the virus spread, but other factors such as sharing snacks may have been involved.

Airflow patterns affect droplet travel

One of the key messages of physical distancing is that if you're outdoors, your risk of contracting the coronavirus is generally lower than if you're

indoors. This is because the virus is more quickly diluted — which means you're exposed to fewer particles.

"If you're in a room and someone coughs, sneezes, or speaks, the droplets they expel can hang around for a long time," said Capecelatro. "It doesn't matter where you are in the room. You are going to be breathing in some of those droplets, especially if there's poor ventilation."

A preprint paper by Japanese researchers found that the risk of transmission indoors is 18.7 times higher than the outdoor risk. This paper has not been peer-reviewed, so the results should be viewed with some caution.

However, not all indoor settings are created equal. Airflow patterns matter and sometimes can make things worse.

"What the airflow can do, especially if it's turbulent, is cause these [virus] particles to cluster, and that will increase the number of particles that you could breathe in," said Capecelatro.

He and his colleagues recently simulated how virus particles exhaled by passengers would spread throughout a bus, in order to reduce the risk of people riding the University of Michigan buses.

Some studies support the idea that poorly ventilated spaces are riskier.

In one case in China, 10 people from three families who visited a restaurant contracted the coronavirus over 1 hour. None of them had direct physical contact with the person with the virus — some were sitting up to 15 feet away.

Outbreaks have also been reported at other indoor settings, including gyms, call centers, and churches.

Many studies, though, have only looked at average airflow rates, not fluctuations in the movement of air within a space.

Another preprint study from researchers at the University of Minnesota College of Science and Engineering looked in more detail at how the coronavirus spreads indoors when exhaled by people. They analyzed three specific settings — an elevator, a small classroom, and a supermarket.

They found that good ventilation can remove some of the virus particles from the air, but many will end up on surfaces in the room.

Study author Jiarong Hong, PhD, an associate professor of mechanical engineering at the University of Minnesota, said if those surfaces aren't cleaned frequently, people may pick up the particles when they touch the surfaces. The particles can also be resuspended in the air and breathed in.

In some cases, poor ventilation can cause "hot spots," locations where the virus particles congregate. Hong's research shows how to fix some of these problems.

“Our tools can predict the presence of hot spots [in a setting] and how to potentially change the ventilation system in those spaces to minimize risks,” said Hong.

Although each space is unique and requires a different approach to reducing the spread of coronavirus, Hong said there are some general approaches that businesses can take to improving their spaces.

This includes putting ventilation sources near the major virus emitters — such as where a teacher stands in a classroom — in order to capture as many of the particles as possible. Opening windows is another option that most spaces can benefit from, he says.

Hong’s research on the spread of coronavirus within different settings also provides some insights into how people can reduce their risk in different settings.

“When you enter a space, you can evaluate the potential [coronavirus] risk,” he said, looking at things such as how crowded the space is, whether people are wearing masks and the airflow.

“For example, if you have to go into a small space that is poorly ventilated, you can decide whether you want to go in there or if you want to shorten your time in that space. These are both things you can do to reduce your risk.”

New model of physical distancing

The authors of the BMJ study developed a new guide to physical distancing that takes many of these factors into account. They use three colors to indicate the relative risk of being exposed to the coronavirus in different settings.

For example, at a backyard party where people can stay far apart from each other and everyone is wearing a mask, the risk is low. People can stay here for an hour or more and still be at low risk. They can even shout or sing if they want.

However, if people take off their masks, this setting is only low in risk if they aren't shouting or singing because the masks are no longer slowing down the cloud of expiratory droplets. And people can only stay there for a long time without a mask if they aren't talking.

"If you're wearing a mask, the 6-foot rule would be quite effective," said Capecelatro, "but if you're not wearing a mask, then you can certainly [contract the virus] at distances beyond 6 feet."

Likewise, if people crowd into a backyard, the only low-risk options involve wearing a mask. In addition, many — but not all — of the high-risk settings involve spaces that are crowded or poorly ventilated.

The BMJ guide is similar to one created by Dr. Ezekiel J. Emanuel and colleagues, which provides more examples of specific activities.

The key thing to both of these guides is that COVID-19 risk varies across settings. Bourouiba's approach, though, emphasizes that 6 feet may not always be enough to keep your risk low.

"The general rule of thumb is that keeping a distance from someone decreases the probability that you're going to be breathing in droplets that they expelled," said Capecelatro. "And while we've been using the 6-foot rule for a long time, we know that you should probably be at least twice that distance away to be more certain."