How Does COVID-19 Spread, Exactly?

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As we tiptoe into a world upended by COVID-19, knowledge of how this novel coronavirus spreads is essential for a safe return to a new normal. But months into the pandemic, there is much we don't know, which makes navigating potential dangers that much trickier.

* Recent comments from the World Health Organization (WHO) raised questions about the risk of catching the virus from infected people who aren’t showing symptoms (asymptomatic and pre-symptomatic individuals). At a press conference held on June 8, 2020, one expert from the WHO referred to this occurrence as “very rare.” The next day, this claim was clarified with more detail in this video statement released by the WHO. The correction emphasizes that, yes, the novel coronavirus can indeed be spread by infected people who don’t feel sick. How often this happens is still unknown.

A growing group of studies does point to one useful fact: COVID-19 is mainly spread by virus droplets launched into the air by someone sneezing, coughing, talking, even breathing. As these particles shed, they can hang out in the air for hours. That's why the U.S. Centers for Disease Control and Prevention suggests people practice social distancing. The farther away you are from the infection source, the fewer of these droplets you will encounter.

Six feet is the accepted consensus. Yet, Bhavarth Shukla, M.D., M.P.H., medical director of infection control at University of Miami Health System, warns: "Some fixate at six feet, but in real life, if you can, I would keep as much distance as is reasonable from the other person."

Here, we offer snippets of science to help you figure out what to do as you resume work, shopping and socializing:

**Evidence has shown that COVID-19 is spread mostly through invisible particles that become airborne.**

The largest particles are droplets, little balls of fluid that contain more of the virus. Gravity pulls them down at about six feet. (Hence, the CDC advice.) Aerosol particles, on the other hand, are much smaller droplets that remain suspended in the air. They contain less of the virus pathogens. "We don't know how much stays in the air," Dr. Shukla admits, "or how infectious those droplets are. But we do know that you need a certain amount to kick off the infection."

Small levels of airborne COVID-19 RNA in the isolation wards and ventilated patient rooms of two Wuhan, China hospitals, according to a study, recently published in *Nature*. But researchers also discovered much higher levels of viral RNA in rooms where workers removed protective gear, in patients' toilet areas (where there is, apparently, less ventilation) and in crowded locations near the hospital.

Though this underscores the virus's ability to remain stealthily suspended all around us, "there are still other questions that need to be answered," Dr. Shukla says. "You have droplets, you have viral RNA, but can they infect you is a whole other research question."

In other words, the Nature study measured only the virus's RNA, not the viable virus particles. So scientists still don't know if the aerosolized COVID-19 particles can
result in infection or how common this kind of transmission is.

COVID-19 aerosol droplets could remain in the air for at least three hours, a study published in the New England Journal of Medicine revealed. Still, the strength of viral infection diminishes considerably over time. When it comes to different surfaces, those droplets can live on for several days. The good news? In May, the CDC updated its guidance to include that the virus "does not spread easily" from touching surfaces or objects. Nevertheless, people still run the risk of infection if they touch a contaminated surface and then touch their nose, mouth, or eyes.

A sophisticated lab simulation showed that "a significant amount" of droplets can travel beyond six feet.

Though the study, published in Physics of Fluids, didn't measure COVID-laden droplets, it calls into question the appropriate social distance length. The study measured droplets from a "mild cough" and found that a wind speed of just one mile per hour can push the droplets even farther and faster than estimated by previous studies that informed the CDC policy.

Carried along on a breeze of 10 mph, which is about average in most U.S. cities, the droplets can travel 20 feet in 1.6 seconds.

While these kinds of studies are invaluable for public health guidance, "the key thing here is that these are done in controlled settings in the lab," cautions Dr. Shukla. "We need to quantify in a real setting."

In the meantime, he suggests that in a public setting, you should try to sit or stand within reason from a person, especially if you're downwind.

Past studies have shown that simple human behavior affects the distance droplets travel.
A sneeze appears to be the most powerful. It can release about 30,000 small droplets at 200 mph. A cough, on the other hand, releases 3,000 mostly large droplets that can travel at 50 mph. A breath releases only 50 to 5,000 droplets at low velocity.

**Even talking might serve as a mode of transmission.**

A study in *PNAS, Proceedings of the National Academy of Sciences of the U.S.A.*, which measured saliva droplets, concluded that a minute of loud speech might generate more than 1,000 droplets that could hang in the air for eight minutes or more.

What does this mean for you in the time of coronavirus? Be aware of your surroundings and the people in your immediate environment. "The key message would be for people in a work setting," Dr. Shukla says. "We tend to generally let our guard down in a break room or common area where people are talking and closer together, and that leads to a greater possibility of exposure."

A handy equation used by researchers can be simplified in this manner:

**Successful infection = exposure x time.**

However, there are no significant studies that show how long you have to be exposed and what amount of the virus (known as the minimal infectious dose, or R.O.) is needed to acquire COVID-19. That said, the CDC warns against big gatherings because it increases successful infection exponentially. "The more people there are in closed proximity, the more chances of exposure," Dr. Shukla says. "The key thing here is to avoid large crowds, parties, concerts, even if in the open air."

**COVID-19 is more contagious than the flu but less than the highly infectious measles.**

For example, the average number of people a person with influenza infects is 1.2.
For measles, it is in the range of 12 to 18. Estimates for the novel coronavirus put the infection rate at somewhere between 2 and 3 people. Keep in mind, however, that there are vaccines for both influenza and measles, as well as actual treatments. Not so for COVID-19. While the anti-viral remdesivir has been approved by the government, Dr. Shukla points out that "it is the only treatment shown to have an effect on COVID 19 so far," but it's used only on the sickest patients.

In the end, Dr. Shukla says that caution, common sense, and good community and personal hygiene are crucial in minimizing the spread of the virus.

Wash your hands.

Don't touch your face.

Physical distance (as much as you can).

Wear a mask in public.

Avoid crowds.

Science proves these behaviors can keep COVID-19 in check.

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