In public toilets, flushing isn't the only COVID-19 risk

Toilet plumes can launch germy droplets in the air. Experts share the precautions you should take before answering nature’s call in public restrooms.

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Few people have the bladder fortitude to last through drinks, dinner, or long road trips without having to use the restroom. But as more restaurants, bars, and other public spaces start to re-open this summer, questions have been swirling around whether using a public toilet could become a more serious health risk in the era of COVID-19.

Such worries came to a head this week when researchers in China published a study suggesting that flushing a toilet can create a plume of coronavirus-laden particles, which are flung into the air by the watery vortex inside a toilet bowl.

Several studies using genetic tests have previously detected the SARS-CoV-2 virus in stool samples, and at least one investigation shows that the coronaviruses in these feces can be infectious. When a person infected with COVID-19 defecates, the germ at first settles into the toilet bowl. But then “the flushing process can lift the virus out of the toilet and cause cross-infection among people,” says Ji-Xiang Wang, a physicist at Yangzhou University in China and coauthor on the paper published June 16 in the journal *Physics of Fluids*.

While the toilet plume effect has been studied for decades in relation to other diseases, many questions remain over its role in spreading germs, including the one that causes COVID-19. Neither the World Health Organization nor the U.S. Centers for Disease Control and Prevention thinks it’s very likely COVID-19 can be spread by bowel movements leading to accidental consumption of virus particles, a route medically termed fecal-oral transmission.

Despite these uncertainties, experts say there are precautions you should take before answering nature’s call in publicly shared restrooms.

**How risky are restrooms?**

For the latest study, Wang’s team used computer models to show that tiny droplets called aerosols, created by the turbulence of water sloshing inside a toilet bowl, could be ejected up to three feet into the air. Shortly after flushing, water rushes into
the bowl, striking the opposite side with enough force to generate a vortex that forcefully pushes not only the liquid, but also the air inside the toilet.

According to their simulations, this combination launches aerosols that can last in the air for just over a minute. The more water used in a toilet bowl, Wang’s team found, the greater the force of the flush.

So what does that mean if you use a restroom after someone infected with COVID-19 flushes? That depends a lot on whether the infectious virus survives in human feces, and that’s still an active area of research.

To start, studies of MERS, a coronavirus relative that flared up in 2012, indicate that this particular virus can survive in the human digestive tract, which is a sign the same might be true for SARS-CoV-2. Flu viruses and coronaviruses are considered “enveloped viruses” because they’re protected by a thin layer called a membrane. Unlike noroviruses, the most common culprit of food poisoning, enveloped viruses are easily degraded by acids, which make them vulnerable to the chemical make-ups of soap and stomach bile.

One hypothesis, based on influenza research, suggests that these kinds of viruses might survive in the human gut if mucus from infected patients protects the germs during their journey through the digestive tract. The question then is how long the virus lasts in fecal matter, and that’s another area that needs more research, says E. Susan Amirian, a molecular epidemiologist at Rice University in Houston.

“Fecal transmission is unlikely to be a major mode of transmission, even if it proves to be plausible,” Amirian says in an email. She notes that the CDC’s assessment of fecal-oral transmission cites one study in which scientists were able to detect only broken bits of the coronavirus’s genetic code in infected patients’ feces. These genetic snippets are an indicator the germ was once present in the body, but the virus has been degraded so much, it can no longer cause an infection.

However, these broken viral bits appear quite often in COVID-19 defecations. Another study published in April found traces of SARS-CoV-2 in the fecal matter of more than half of 42 patients tested. And a May 18 report published by the CDC found viable and infectious SARS-CoV-2 in fecal excretions from a handful of patients.

What’s more, past studies show that fecal-oral transmission may have occurred during the 2002-2003 outbreak of SARS, another coronavirus cousin of COVID-19. Airborne fecal matter was thought to have exacerbated a cluster of 321 SARS cases at a Hong Kong apartment complex in 2003. Later examination of the incident found poor ventilation, contact with neighbors, and shared spaces such as elevators and stairwells also contributed to the event.

“What using a public restroom, especially while taking precautions like maintaining physical distance from others and practicing good hand hygiene, is quite likely to be less risky than attending a gathering with people from other households,” Amirian says via email. She emphasizes that “the major mode of transmission for COVID-19 is person-to-person through respiratory droplets.”

**What can you do to protect yourself?**

Still, “less risky” isn’t the same as no risk, and exactly how well the virus survives in feces, on surfaces, and in the air are questions scientists are still trying to answer.

A study published last April in the *New England Journal of Medicine* showed the virus could live on steel and plastic surfaces for up to two and three days, respectively. A simple solution of soap and water can easily destroy the virus. But that means public restrooms can harbor COVID-19 germs if establishments don’t take care to wipe down surfaces.
“At the end of the day, we need to remember that stool can be a reservoir for many diseases, and people sometimes don’t wash their hands as well as they think they do,” says Amirian. “Good hygiene, especially thorough hand washing, is important for reasons beyond COVID-19.”

In public restrooms with multiple stalls that don’t limit the number of people allowed in, clusters of individuals represent an additional risk, as person-to-person contact is still the primary way people become infected with coronavirus.

Joe Allen is the director of Harvard’s Healthy Buildings Program, where he researches how our offices, schools, and homes can influence our health. In investigations of buildings that adversely impact human health, Allen says, “I always remind people to check the exhaust in the bathroom.” He adds that improving ventilation that moves dirty indoor air outside is one of the best ways to safeguard against a contaminated restroom.

“[Public] bathrooms should have exhaust fans that are constantly running,” Allen says.

Manufacturers should design a new toilet, in which the lid is automatically put down before flushing,” says Wang.

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