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Putting medical and nutrition news in historical, scientific, and just plain practical context.

What Determines the Virulence, i.e. the Harmfulness, of a Virus? Part One

by Ann Gerhardt, MD March 26, 2020

I'm not a virologist, but in this article I describe SARS-CoV-2's commonly known characteristics that affect its ability to cause COVID-19, the disease. This should inform the next article about humans' immune response to the virus, which is more my line of work.

So that I don't have to repeat the phrase "according to what is currently known about SARS-Cov-2" please assume that that phrase should be added to each sentence mentioning the virus.

Transmissibility to and between humans: SARS-Cov-2 doesn't fly. It stows away on saliva droplets emitted with a cough, spit and the mist emitted with talking, particularly the letters B, P and T. That saliva may be inhaled by a person close by. Or it follows the laws of gravity, slowly falling to the ground. If we talk to someone 6 feet away, we shouldn't infect each other, outside of a spitting match.

Tiny saliva particles might evaporate, leaving floating viral particles to die within 2-3 hours. If suspended viral particles remain in air into which we walk, we would have to inhale enough virus to cause an infection. Unfortunately, we don't yet know what that number is, but it's certainly more than one.

COVID-19 patients harbor SARS-Cov-2 in saliva, blood, coughed up sputum, stool and possibly other bodily secretions. Any contact of those, usually via inhalation or a hand, with eyes, nose, mouth or lungs might cause infection. There is no evidence that SARS-Cov-2 can enter the body through skin. I imagine that it's possible to enter through an open wound.

Survival outside humans: Some organisms like fungi become spores that survive outside a host for a long time. That's not SARS-Cov-2 or any other virus. Viruses have no hibernation form, but they do vary in their tolerance of dryness, acidity and temperature when outside of a host. They do better on water-less surfaces, like steel and plastic.

SARS-Cov-2 is moderately hearty outside a host. Short-lived viruses include HIV and Herpes virus. Cold and influenza viruses can survive for as little as a few minutes to as much as 48 hours. Norovirus, known for causing cruise ship diarrhea, last for weeks outside a host and Hepatitis A virus can remain infectious for months in water or feces.

A recent study in the New England Journal of Medicine of simulated SARS-Cov-2 viral aerosol and solid-surface deposition established the longest survival time as 72 hours on steel and plastic surfaces, with lesser times for other solids. The longest half-life for viability (the time in which half the existing load will die) is 6.8 hours on plastic. Just finding viral RNA genetic material on a surface doesn't mean there is an intact virus capable of causing an infection.

It takes a critical mass of intact virus particles to produce infection. So, before you touch a public surface, consider that there is no way of knowing when and how much virus was deposited on it and how many viable virus particles remain. No matter what the half-life, don't touch your face and wash hands after any public object contact.

There is no evidence that SARS-Cov-2 survives in drinking water, hot tubs or pools. Just don't share a glass. It likely persists in sewage for days...so wash after any exposure to untreated water or waste before those hands get anywhere close to your face.

Survival and growth are two different things. Growth doesn't mean they grow bigger, they just duplicate themselves. Most viruses have adapted to specific hosts which don't kill them quickly and which provide building blocks for replication.

A virus' basic genetics determines 1) which animal types serve as good hosts; 2) how strongly it will attach to and enter a cell; 3) how rapidly it will replicate in the cell; 4) in what ways it damages host cells; and 5) what kind of immune response it induces. All of these influence its virulence and are active lines of scientific investigation.

So far, we know that it doesn't survive exceptionally long outside the body, it's only transmitted via human infected fluids, once inside the body it may or may not cause disease and it's at least six-fold more fatal than influenza virus. At least it doesn't mutate quickly, the way Influenza virus does. This allows scientists to characterize one, non-shape-shifting virus and discover useful facts.

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