



COVID-19 IS A DISEASE OF CROWDED INDOOR SPACES WITH POOR AIR EXCHANGE AND NO MASKS

Boyd C. Hoddinott, MD, MPH, Health Commissioner

December 21, 2020

That title is all you need to know but read on for further information if you wish. There are now close to 60,000 articles and videos available on COVID-19.

1. The Virus

Most RNA viruses use the human cell cytoplasm to reproduce themselves and thus, in a sense, mutate with every reproduction. The COVID-19 virus does not mutate as readily as most influenza viruses. The last serious coronavirus pandemic is thought to be the 1889-90 "Russian Flu" that killed a million people in a population of about 1.5 billion. It is still with us as one of the four common cold coronaviruses.

2. Statistics

The USA is the leading country with 300,000 deaths, but the European nations in total have almost 200,000 more. The USA, however, is eleventh in deaths per million population. Over 40% of US deaths have occurred in long-term care facilities. 14% of cases occur in people over 65, but that group accounts for 80% of the deaths. In Ohio, with close to 600,000 cases and 7,600 deaths, there has not been one death in anyone under age 19. Per the CDC, 94% of deaths have occurred in individuals with at least one co-morbidity condition and the average is 3 co-morbidity conditions. Age is the number one risk factor while obesity is number two.

3. Testing

This is still a mess with hundreds of tests of varying specificity and sensitivity.

Antigen: Rapid and on-site but with a high false positive rate.

PCR: Tests for parts of the virus RNA and though 100% accurate, the sensitivity is dependent on how many times (cycles) the test is run as it is set up to find increasingly smaller snippets of RNA. Most US tests seem to be around 40 cycles (CT), but Britain has not found live virus in any cycle past 28. So, false positives also happen with PCR.

Antibody: There are many such tests, including rapid for on-site use in offices, airports, etc. They are not as accurate as those done in a laboratory which take much longer. It is not yet proven how long antibodies (of which there are different types) continue to show in the blood, whether there is still immunity when they fade, and whether killer "T" cells are a more accurate measure of protection.

Viral Culture: This is the most accurate, but because of expense and amount of time for receiving results, is mostly used in research.

4. Spread

The variety and different accuracy of the many tests, and the more recent realization of the extent of airborne infection has led to widely varying estimates of asymptomatic spread. It is likely more than 20%. The size of the viral load is especially important in determining illness. Viral load expelled is somewhat proportional to how sick the spreader (sick person) is. Also, there are at least four non-specific body systems that could deal with the small viral loads without the necessity of specific antibodies that vaccines can develop.

Since the onset of the pandemic, three main ways of spread have been purported, *droplet, surface, and airborne (or aerosol)*. Droplets have been measured from the nose and mouth at anywhere from 0.1 micron

(the size of the virus) to 1,000 microns. The heavier particles fall quickly to the ground, onto surfaces and attach to masks. This is where cleaning is effective.

In the absence of ventilation, a 10-micron particle (considered to be the largest size that can be airborne) takes 8 minutes to fall to the ground. A 0.5-micron particle takes about 56 hours in similar circumstances.

There has not been any proof of any spread of the virus through food. Even surface spread has been difficult to document.

5. Air Quality

Air quality is paramount to prevent airborne spread as that is likely the most common means of spreading the infection. There are three means to improve air quality:

Ventilation: It has been shown that an air change of six times per hour essentially stops even the most contagious diseases from spreading; that of course, is impractical in extremely hot or cold weather. However, even opening a vehicle window just 3 inches can dilute the circulating virus by 90%. In buildings, if air changes only occur 2 to 3 times per hour then additional air cleaning resources need to be added.

Filtration: HEPA and MERV-13 rated filters can cleanse the air of viruses, bacteria, mold, and pollen down to the 0.1-micron size. They are expensive to replace.

Purification: Ultraviolet light (UV) and ionization are the two best-known air disinfection systems. Traditional UV has been used in hospitals for almost a century. It sterilizes the air but cannot be in the direct sight of humans as it can damage the eyes and skin. "Far UV" is completely safe at its 220 wavelength where it can be placed on the ceiling so it can also sterilize surfaces. Ionization can be in the central heating and air conditioning (HVAC) system or just locally in an air duct. Newer systems do not produce high levels of dangerous ozone. The advantage of ionization is that the negatively charged ions stay in the air and can grab particles floating in a room as well as sterilize when they settle on surfaces. Both UV and ionization neutralize viruses, bacteria, mold spores and pollen. A third system now available called "APHCO" is similar to the technology that is used in the space station. Stand-alone individual room units can have a combination of charcoal filters, UV light, HEPA filters, ionization, and APHCO.

6. Masks

Masks on the spreader (sick person) have been known to be highly effective since the 2003 SARS outbreak. Even standard multi-layer cloth masks keep droplets and solids stuck on the mask preventing at least 65% of the spread of particles down to 0.5-microns in size. Those that are smaller are not contained. N95 masks work much better and have an electrostatic middle layer. With over 130 mask studies now published, there is no doubt that masks work for source control, but they are much less effective in protecting the wearer.

7. Treatment

Although there are no absolutely specific medications, improved understanding of the disease has helped to reduce the seriousness of the illness and reduce hospital stays. Critical COVID-19 cases are now viewed as vascular and immunological issues.

8. Vaccination

As of today, the Pfizer COVID-19 Vaccine is only being delivered in half of the expected quantities and will be used in Ohio in nursing homes. It is two shots, 3 weeks apart for the full 90+% protection. The Moderna vaccine is given a month apart and produces 50% protection 2 weeks after the first dose, and also over 90% protection after the second dose. Both vaccines have been shown to have mostly mild reactions in trials. They use a totally new genetic technique that has cut new vaccine development by several years, and will generate immunity that will be stronger than actual infection. Other COVID-19 vaccines are also on the way.