# Fluid Mechanics of COVID-19

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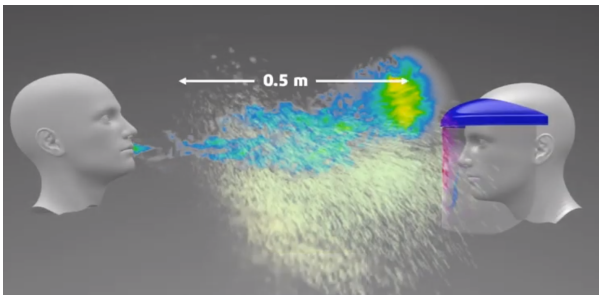
**Introduction**

The spread of COVID-19 has increased exponentially over the last few months. The spread of an airborne virus is one field of study for fluid mechanics in different ways. The most common ways a virus spreads is through germs entering the eyes, mouth, or nose. In order to help slow the spread, the CDC has recommended all people (sick or healthy) wear masks. The four sources used are used to analyze how COVID-19 is spread with and without masks, as well as how computational fluid dynamics is used in simulations to gather and analyze data in ways that germs can come in contact from person to person. One source is a journal post from a doctor studying the spread in a work office environment. Another source comes from the National Academy of Sciences that analyzed how spoken words can be one of the most missed ways the virus can spread; it does not always just spread from coughing or sneezing. MIT also released a news article that expresses the true "distancing" measures that should be practiced over the ones in place now. Lastly, one of MIT's doctors posted an article covering the disease transmission through respiratory emissions.

**Summary**

The air around us is not safe when there is an airborne pandemic sweeping the world. Especially in crowded places like schools and offices, it is much easier for germs to spread through HVAC systems to the entire building. With the CDC's social distancing practice of staying at least 6ft apart from another person, the simulation pictures can visualize how an uncovered cough can spread germs through a cloud of gaseous droplets between a group of office workers. While 6ft is a recommended distance, "the right distance is a function of the reach of the pathogen" (Tabatabai, 2020). Dr. Tabatabai is implying that a pathogen can travel more than just 6ft. For example, a sneeze can travel up to 80 mph and a fast, unexpected sneeze from an asymptomatic carrier can still spread to another person with a weaker immune system, which can result in more lethal cases of the virus as it affects everyone differently.

Another visual presented by Dr. Tabatabai, showing how a face covering can shield from the sneeze of a person without a face covering. These face coverings are meant to shield the well from infection, and prevent any carriers from spreading the virus.



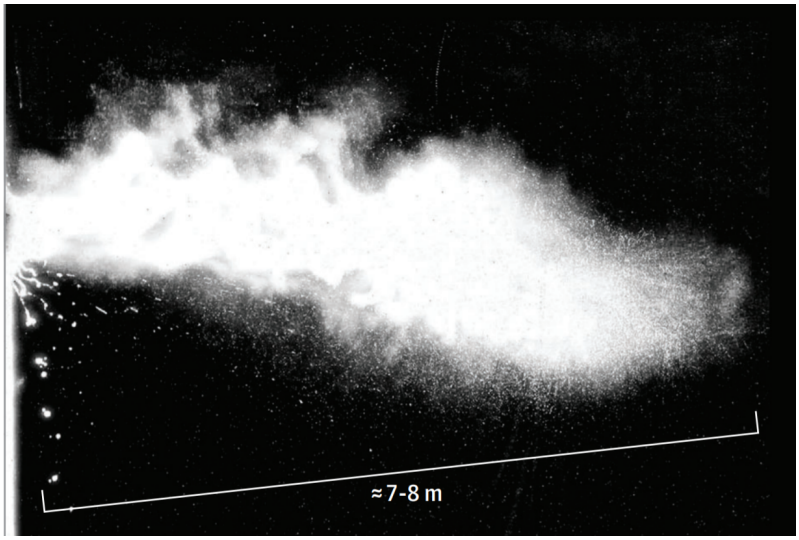
The act of sneezing or coughing is not the only way the virus is able to spread. A big misconception of the pandemic is that speech is not an influence of the virus. “The simple act of speaking also propels droplets into the air—though typically too small to be visible”, meaning volume spoken is a variable of the spread (Beans, 2020). Breathing is also a possible way of spread, especially mouth-breathing. Carolyn Beans’ research showed that when voices are raised, an increase of droplets are emitted. The louder one speaks, the higher risk that person is of spreading germs to other people.

In essential workplaces, most companies now require that their employees wear face guards in order to misdirect the droplets emitted through speech when interacting with customers. While this is a helpful precaution, it is not guaranteed to be the safest. Misdirection does not mean immunity to the virus exists. However, masks are on backorder due to the sudden high demand of the world. People are resorting to homemade masks. The CDC recommends cloth face coverings to catch any droplets or misdirect them upwards/downwards instead of forward at other people. Homemade coverings are better than no coverings at all, so it makes sense why the world should be coming together in unity to create their own masks until medically-approved masks are globally available.

The world has changed quickly in the way humans can interact with each other anymore. When people hear “social distancing” they think 6ft apart. This may actually not be the safest distance. According to Lydia Bourouiba’s experiments of disease transmission, “a cough can transmit droplets up to 13 to 16 feet, while a sneeze can eject them up to 26 feet away. Surrounding air conditions can act to further disperse the residual droplets in upper levels of rooms”, resulting in raised concerns of our current social distancing standards (MIT News

Office, 2020). Should social distancing practices be ramped up to what MIT found in their experiments? If droplets are able to travel past 6ft, there should be an increase of distance between people to really slow the spread of the virus.

There are also raised warnings for hand washing. In words, it is very simple. Do not touch your face, and if you need to wash your hands before. In workplaces employers are requiring hand washing at the top of every hour, at the least. This can be one of the best practices for local communities as people are starting to carry mini bottles of hand sanitizer and applying when coming in contact with any high-contact areas (doorknobs, handrails, screens, computers, etc).




This graphic depicts how droplets are not just liquid. The transmission of respiratory pathogens actually travels in gas clouds (Bourouiba, 2020). These gas clouds are what travel much farther than the recommended 6ft (2m), as opposed to the liquid droplets from saliva, which travel closer to 6ft before falling to whatever surface is near. Larger droplets settle faster onto surfaces than they evaporate. When they settle the surfaces now become contaminated, which can spread the infection to the next person to be in contact with that surface. This proves why every essential worker is required to sanitize their work station as often as possible to avoid the settlement of contaminated surfaces.

**Predictions**

The coronavirus pandemic unexpectedly came to the world and has been spreading exponentially. This has opened the gate to fluid mechanics in disease control by studying and experimenting the ways disease spread. While this pandemic will change how the world operates from here on out, the value of life and connection to loved ones has become relevant in ways some took for granted before quarantine. The field of pathogen transmission is now much better understood because the modern world has not seen a global pandemic like this before COVID-19 hit. More efficient masks will be produced, air ducts can be engineered to prevent the transmission of an airborne illness, and better environments for crowded places can be put into practice are all some examples of how the fluid mechanics studies of COVID-19 will shape the future of the world we live in.

# Works Cited

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