

SARS-CoV-2 (COVID-19) Variants

Viruses mutate. Often. A mutation is any change in the virus's genetic sequencing or coding. This occurs naturally when the virus replicates within a cell because a virus's entire goal is to replicate quickly and spread to other living things. Given time, and enough infected organisms (in this case, humans), mutations and, occasionally, variants will arise.

A virus is not alive. It is a particle with a collection of genetic material – either DNA or RNA – and requires a host (a living thing) to survive and thrive. In contrast, bacteria are living organisms that can live independently of other organisms, some better than others. For instance, anthrax (a bacteria) can survive in soil for years and then infect an organism when it has the chance.

When a virus's genetic code has changed, it might be just one change out of all the genetic code, but is often more. The result of that is a significant change in the viral genome, which may then become a viral variant of the original virus. This can happen repeatedly. It may prove different in transmissibility (the ability to move and cause disease from one organism to another), virulence (the severity of the illness), or antigenicity or immunogenicity (the organism's immune response to the virus). Which brings us to perhaps the most confusing piece of this issue. Even amongst the scientists, medical personnel, and especially lay media, the terms mutation, variant, and strain, are often used interchangeably, even if they shouldn't be. Fortunately for us, the experts will identify it, and when appropriate, name it, and then tell us when it matters. But there are two keys to viral variants. It has to be actively looked for by the scientists who study and sequence viral genomes, and then worked out what a new variant's impact is from a disease standpoint.

The CDC lists the following as potential consequences of new variants:

1. The ability to spread more quickly in humans.
2. The ability to cause either milder or more severe disease in humans.
3. The ability to evade detection in diagnostic tests that have previously detected the non-variant virus.
4. Decreased susceptibility to therapeutic agents (treatments).
5. Ability to evade natural (exposure to disease) and/or vaccine-induced immunity.

What is not known at this time, according to the CDC (although updated info is always being published) includes:

1. How widely these variants have spread?
2. How the disease from the new variants differs from the other variants already circulating?
3. How these variants affect current therapies & vaccines?

There are some countries, including the UK, Japan, and Nigeria, that have excelled at viral sequencing of COVID virus specimens, taken from a sampling of those that are acutely ill with the virus.

The US has announced a plan to increase the amount of viral sequencing done. The plan includes sampling from state and other public health agencies, partnership with national reference labs, contracts with 7 universities, sequencing within state and local health departments, and via the SPHERES Consortium, to coordinate US sequencing outside of the CDC, amongst more than 160 different institutions. A large increase in COVID viral sequencing is expected beginning in January 2021.

As of 1/15/21, the CDC has posted the following regarding officially recognized COVID-19 Variants.

(Note that the naming of the variants is a task being explored by the WHO Emergency Committee so that every nation can be comparing like to like and avoiding negative connotations for those countries that ID the variants via their sequencing. In lieu of that guidance, there are currently two or more "names" for each new variant. All the "names" will be included so that those reading the literature can more easily connect the different variants. Also, info in the parentheses is added by me and is not from the CDC.)

1. SARS-CoV-2 Variant known as **B.1.1.7 lineage** or **20I/501Y.V1** or **VOC 202012/01**:

- This variant is estimated to have emerged in the UK in Sept of 2020.
- Since Dec of 2020, 30 countries have reported cases of this variant, including the US and Canada (per the ECDC, as of 1/19/20, 60 countries have reported cases).
- This variant is associated with **increased transmissibility** (it is more efficient and rapid transmission) reportedly by **stronger attachment to the human cell protein** and an **increased viral load** (amount of virus produced and capable of spreading to others).
- There is no current evidence to suggest that it makes the severity of the disease worse or that it changes the current vaccines' efficacy.

2. SARS-CoV-2 Variant known as **1.351 lineage** or **20H/501Y.V2**:

- This Variant was first ID'd in South Africa in Dec 2020 & traced back to samples from Oct 2020.
- This Variant was also ID'd in Zambia in late Dec 2020 and appeared to be the dominant variant there.
- (Per the ECDC, as of 1/19/21, 22 (sic) countries have reported cases so far including 12 countries in Europe, 4 in Asia, 3 in Africa, and 1 each in Australia, Brazil, and Canada.)
- There is no current evidence to suggest that this variant has any impact on disease severity.
- There is evidence to indicate that one of the mutations in this variant may cause the **neutralization of some monoclonal and polyclonal antibodies**.

3. SARS-CoV-2 Variant known as **P.1 lineage** or **20J/501Y.V3 (off the B.1.1.28 branch)**:

- This variant was first ID'd by Japan in 4 travelers from Brazil (upon routine screening) and then in South Korea in travelers returning from Brazil. It has an identical genome to that found in Brazil.
- There is evidence that some of its mutations may affect **its transmissibility and antigenic profile, which may then affect the ability of antibodies developed as a result of having COVID or the vaccine to recognize and neutralize (successfully fight) the variant virus.**
- A recent study from the cluster of cases in Manaus, Brazil, showed this variant (P.1) was identified in 42% of the samples from late Dec 2020. On the other hand, in the same region, it is estimated that, as of October 2020, about 75% of the population had previously been infected with COVID-19 but, since mid-Dec., there has been a surge in cases. (The finding of the variant in such large numbers, in a population that should have been $\frac{3}{4}$ immune, suggests that there is something about this variant that increases the transmissibility or allows reinfection of SARS.)
- This variant has not been detected outside of Brazil, except for those associated with travel from or to and from Brazil.

(Note: there is no way to know how much spread of the variants there is without lots of genome sequencing. And, at this point, few countries are doing an adequate number.)

Virologists, Epidemiologists, and Infectious Disease Experts seem to agree that in order to get ahead of just the B.1.1.7 variant, the population of the US, and likely Canada, need to be well along in vaccinating the general population. The goal is to prevent any of the global variants from becoming the predominant strain. Because, as bad as the current SARS-CoV-2 virus is, particularly when it comes to overloading health care/hospital systems, a variant that is 56-70% more transmissible is not what you want in an unprotected/under-protected population.

And, until most of the population is protected (experts now suggest 85-90% need vaccinations due to the greater contagiousness of the variants), the risk of a more dominant strain(s) is possible. However, only applies to increased transmission and does not take into account a variant that neutralizes antibodies from previous disease or vaccine and/or no longer responds to mono/polyclonal antibodies or other treatments. The more times a virus transmits from person to person (or to any living organism), the greater the risk for mutations and new variant(s), or even completely new strain(s).

Finally, for some good news, although mutations are going to occur as long as the virus is transmitting to new hosts, the experts feel that a major mutational change that would render all vaccines and testing useless would be at least a couple years, not months, down the road.

So, although everyone admits that we just want COVID-19 and its restrictions to **go away now**, that is not going to happen until there is enough of the population vaccinated against the circulating virus (remember, likely 85-90% in most areas with community

transmission COVID-19). **Until that occurs, even if you have had your complete vaccination, you must, to protect yourself and others:**

1. Use ongoing **proper** mask wearing unless you are inside with only your constant household bubble. Note that an attempt is being made to provide better masks (ideally N95s) for everyone except very young children. Even with a mask, you must still maintain 6 feet/2 meters between each person not in the same household group.
2. If someone in your household bubble has ongoing exposure due to work or school, consider alternative arrangements for one of you, or both should wear a mask when in common areas.
3. Wash your hands & lower arms often, with soap and running water, using friction between the hands for at least 20 seconds, before rinsing. Do this particularly when you have sneezed or coughed, touched a potentially contaminated item, gone to the office, grocery, doctor's appointment, or anywhere else outside your own home.
4. Use hand sanitizer or wipes, both with at least 70% alcohol, when handwashing is not feasible. Then, ASAP, wash your hand as in #2.
5. Consider wearing eye goggles or a full-face shield to protect your eyes when indoors anywhere outside of your home. The face shield adds a level of protection to your mask. DO NOT use a shield without a mask.
6. Avoid touching your face, especially your eyes, nose and mouth since this can introduce virus to your mucous membranes and cause infection.
7. Avoid people who are coughing, sneezing, or look ill. On the other hand, also avoid those that are at increased risk for serious illness or complications from COVID – for any reason.
8. Wipe down surfaces and 'common touch' items in your home or at work with an approved antibacterial solution. Leave the solution on for the time listed on the bottle; recommended times are not all the same.
9. Avoid enclosed spaces with anyone except your household bubble. Those areas that have had frequent transmissions and even super spreader events have included restaurants, bars, gyms, hotels, places of worship, cultural or entertainment areas, meeting rooms, or gatherings with more than 6-10 people, even when outside.

If we can keep this up for the rest of Winter and Spring, our late summer and fall could have us back to near normal. Stay turned to the latest information from the CDC, PHAC or reliable Medical News or Standard News outlets.

A separate list of Links & Resources on COVID-19 Variants is included with this post. It offers a variety of items to read, or just to be aware of should you need a reference. They include Public Health Guidance and Explanations (CDC, PHAC, WHO), as well as Medical News and Standard News articles too.

Green highlighting indicates those resources that I think are the most essential to read for a good understanding of the topic. In particular, there is a Physician/Staff Writer for *The Atlantic*, with an article that outlines the ABCs of Viral Variants in general, and COVID-19 in particular. The article is an easy read, not too long, and worth your time if you are looking for information on the topic.