

COVID-19 VARIANTS

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BACKGROUND

- All viruses mutate and change naturally. When mutations fundamentally change the characteristics of a virus (its structure and/or behavior) we classify them as variants.
- SARS CoV-2 is constantly mutating. To-date a growing number of distinct variants have been identified, their genetic mutations have the potential to affect the trajectory of the pandemic. More variants are sure to emerge.
- Variants are classified as Variants of Interest (VOI), Variants of Concern (VOC), and Variants of High Consequence (VOHC) based on evidence of their transmissibility and severity, and ability to evade current testing, treatment, and vaccinations. As of yet no Variant of High Consequence (the most worrisome classification) has been identified, meaning that testing and vaccinations that have been developed should continue to provide reliable diagnostic and protective effects.
- **Core pandemic response strategies should not change:** community mitigation, testing, contact tracing, supported isolation, and vaccination. Variants may be more transmissible, infectious, and able to evade diagnostic, therapeutic and antibody responses; this **reinforces the need for comprehensive strategies** to prevent their spread. Decreasing spread is key to preventing opportunities for new variants to develop.

SOME SPECIFICS

There are currently four SARS-CoV-2 Variants of Concern, [all have been detected within the US](#). The following table describes their characteristics as compared to the original, “wild type” SARS-CoV-2 variant:

Name (location first identified)	Where detected	Transmissibility	Severity of infection
Delta / B.1.617.2 (India)	86+ countries	Increased transmission (Predominant strain in U.S.)	More research needed
Alpha / B.1.1.7 (United Kingdom)	166+ countries	Increased transmission	Increased severity
Beta / B.1.351 (South Africa)	109+ countries	Increased transmission	More research needed
Gamma / P.1 (Japan/Brazil)	69+ countries	More research needed	More research needed

- Mutations and implications: The identified coronavirus variants contain many mutations, however the most relevant mutations affect the spike protein on the surface of the virus, this is the part of the coronavirus that attaches to human cells and causes infection. Changes to the structure of this protein can affect how well it binds to and infects human cells, and these changes can influence:
 - Transmission- which may increase the [reproductive number](#)
 - Infection severity – which may increase likelihood of hospitalization and death

- Diagnostic tests, treatments, and approved vaccines all use the SARS-CoV-2 spike protein as the target of their interventions, thus any changes to the structure of the spike protein are concerning, as they may reduce the efficacy of our diagnostic, therapeutic, and prevention measures.
- In addition to the Variants of Concern, there are a number of additional Variants of Interest. These variants have mutations that may enhance evasion from antibodies or bind more tightly to cells, but have not been proven more transmissible or infectious.

IMPLICATIONS FOR TESTING

- Many COVID-19 tests are designed to identify the spike protein, including all approved antigen tests. For now, PCR and antigen tests are able to detect current variants as SARS-CoV-2, but not able to distinguish between different variant types
- Increased genomic surveillance capacity is needed to detect new variants, and to improve our understanding of specific outbreaks and the effectiveness of vaccines and therapeutics.
- The US continues to ramp up genomic surveillance capacity. In lieu of comprehensive genomic surveillance, we must assume that all outbreaks within communities involve a highly transmissible variant; community mitigation, detection, supported isolation/quarantine, and vaccination are the best defenses

IMPLICATIONS FOR VACCINES

- All currently approved vaccines (and convalescent plasma treatment) target the spike protein, so mutations that alter that structure raise the concern that further mutations could impact the efficacy of such interventions.
- **The current vaccines provide strong protection against severe disease, hospitalization and death, across all current viral variants.** Importantly, the high efficacy data from the vaccine trials means that even moderate reductions in efficacy against different variants would still provide a real degree of efficacy at the individual level, and help slow the pandemic.
- In general it's easier for vaccines to prevent the worst outcomes of an infection than to prevent mild cases or block infection entirely. In the case of variants, we're seeing encouraging signs that while breakthroughs, mild infections, and transmission may occur with vaccination, severe outcomes are rare so far.
- To move towards epidemic control, and to protect communities most at-risk we need to vaccinate people as quickly as possible.

The ideas presented in this document reflect the latest public health thinking and scientific evidence as of July 2021. You are advised that the COVID-19 vaccine landscape remains highly fluid, and it is your responsibility to ensure that decisions are made based on the most up-to-date information available. Partners In Health does not provide medical advice, diagnosis or treatment in the United States. Always seek the advice of a physician or other qualified health care provider with any questions regarding a medical condition. The information, including but not limited to, text, graphics, images and other material contained in this document, are intended for informational purposes only.

SOURCES:

1. <https://www.ecdc.europa.eu/sites/default/files/documents/SARS-CoV-2-variant-multiple-spike-protein-mutations-United-Kingdom.pdf#page=13>
2. <https://www.statnews.com/2021/01/09/we-lost-to-sars-cov-2-in-2020-we-can-defeat-b-117-in-2021/>
3. <https://www.sciencemag.org/news/2021/01/viral-mutations-may-cause-another-very-very-bad-covid-19-wave-scientists-warn>
4. <https://directorsblog.nih.gov/2021/03/30/infections-with-u-k-variant-b-1-1-7-have-greater-risk-of-mortality/>
5. https://www.cdc.gov/mmwr/volumes/70/wr/mm7003e2.htm?s_cid=mm7003e2_w
6. <https://www.nytimes.com/interactive/2021/health/coronavirus-mutations-B117-variant.html?action=click&module=Top%20Stories&pgtype=Homepage>
7. <https://jamanetwork.com/journals/jama/fullarticle/2776739>
8. <https://jamanetwork.com/journals/jama/fullarticle/2776543>
9. <https://www.cdc.gov/coronavirus/2019-ncov/cases-updates/variant-surveillance/variant-info.html#Consequence>
10. <https://outbreak.info/situation-reports>
11. https://www.nejm.org/doi/full/10.1056/NEJMc2104974?query=featured_coronavirus
12. https://www.statnews.com/2021/05/13/vaccines-work-variants-complicated/?utm_source=STAT+Newsletters&utm_campaign=a47d6e56fd-MR_COPY_02&utm_medium=email&utm_term=0_8cab1d7961-a47d6e56fd-149648513
13. <https://covid.cdc.gov/covid-data-tracker/#variant-proportions>
14. <https://covid.cdc.gov/covid-data-tracker/#global-variant-report-map>
15. https://cov-lineages.org/global_report.html
16. https://www.cdc.gov/mmwr/volumes/70/wr/mm7037e2.htm?s_cid=mm7037e2_w
17. https://www.cdc.gov/mmwr/volumes/70/wr/mm7037e1.htm?s_cid=mm7037e1_w