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CORONAVIRUS

Covid-19: How many variants are there, and what do we know about them?

Eight notable variants of SARS-CoV-2 have been found since September 2020. **Elisabeth Mahase** reviews the line-up so far

Elisabeth Mahase

Alpha

Considered a variant of concern by the World Health Organization, alpha was first identified in Kent in the UK in September 2020 and drove the UK's second wave.

While it was first thought that this variant was around 70% more transmissible than the original (wild-type) SARS-CoV-2 coronavirus, data now suggest that it is 30-40% more transmissible than the original.¹

Research has shown vaccine efficacy (two doses) against the alpha variant to be 74.5% with the Oxford-AstraZeneca vaccine, 93.7% with the Pfizer-BioNTech vaccine,² 85.6% with the Novavax vaccine,³ and 100% with the Moderna vaccine.⁴ A study looking at the Sputnik V vaccine saw some reduced neutralising activity against the alpha variant,⁵ and Thailand's Public Health Ministry has reported that two doses of the Sinovac vaccine are 71-91% effective against alpha.⁶ (Video 1)

Video 1 Covid-19: Variants of concern

Beta

First documented in South Africa in May 2020, beta is also considered a variant of concern by WHO.

The US Centers for Disease Control and Prevention (CDC) has linked beta with a 50% increase in transmission,⁷ but the big worry is the emerging evidence of its ability to evade some of the existing vaccines.

Early studies indicate that the Pfizer vaccine has a slightly lower (72-75%) effectiveness against beta than against the wild-type SARS-CoV-2, but both Pfizer and Moderna say that their vaccines are still 95% effective against severe disease and death. Novavax (60%) and Johnson and Johnson (57%) fare slightly worse. And, while early studies of the Oxford-AstraZeneca vaccine seemed to show low efficacy against beta, real world data published on 23 July indicated 82% effectiveness in preventing severe disease and death from covid after a single vaccine dose.⁸

Sputnik V's maker claims that it is "highly effective" against beta, but at least one study has noted a reduction in neutralising activity against this variant.⁵ Data on the efficacy of Sinovac's CoronaVac are lacking, although reports from Hong Kong suggested that the level of protection was 70% lower against beta than against wild-type.⁹

Gamma

Gamma was first identified in Manaus, Brazil, in November 2020 and is another variant of concern for WHO. At the time of writing it remains the dominant variant in South America.¹⁰

Research suggests that gamma is 1.7-2.4 times more transmissible than wild-type SARS-CoV-2.¹¹

Few studies have been conducted to determine the efficacy of covid vaccines against the gamma variant. However, a report looking at an outbreak of gamma among employees of a goldmine in French Guiana noted a "strikingly high attack rate" among people fully vaccinated with the Pfizer vaccine, as 60% of the fully vaccinated people became infected, compared with 75% of unvaccinated miners without a history of infection.¹² The manufacturers of Sputnik V claim that it is "highly effective" against variants including gamma, but a study published in July looking at antibody responses found reduced neutralising activity against gamma and other variants.¹³

Delta

A WHO variant of concern now dominant in Europe and the US, delta continues to drive a steep rise in cases throughout much of Asia including Bangladesh, Iran, Iraq, Japan, Kazakhstan, Malaysia, Myanmar, Pakistan, South Korea, Thailand, and Vietnam,¹⁴ as well as in India, where it was first identified in October 2020.

Delta is the most transmissible form of SARS-CoV-2 detected so far: as much as 60% more so than the alpha variant, one study estimated. Researchers have described it as an "improved" version of the alpha variant thanks to a mutation that makes it more infective in the airways. This means an increased amount of virus in the infected person such that they may expel more virus into the air, and one preprint study concluded that infected individuals had viral loads as much as 1260 times higher than people infected with wild-type SARS-CoV-2.¹⁵ Another concern is that if the delta variant is better at infecting human airway cells people may become infected after lower exposure.¹⁶

The data so far are positive regarding existing vaccines: research suggests vaccine efficacy of 67% with the Oxford-AstraZeneca vaccine and 88% with the Pfizer-BioNTech vaccine against delta, while the

manufacturers of Sputnik V claim that it is 90% effective against it.

Another development is the emergence of delta with a K417N spike protein mutation, which has been termed delta plus. As of 23 July England had reported 45 cases of this variant. Colin Angus, a public health policy modeller and analyst, told the *Washington Post* that the delta plus cases had primarily been in younger people but that preliminary data showed that antibodies from vaccinated people were still effective against this variant.¹⁷

Eta

Cases of the eta variant have turned up in 72 countries including Nigeria and the UK, where it was first detected in December 2020. Little is known about eta, although the CDC said that it has the potential to reduce the neutralising ability of some monoclonal antibody treatments and convalescent plasma. WHO has declared it a “variant of interest,” its second tier level of alert.

Iota

As with eta, little is known about the iota variant, which was first identified in New York City, USA, in November 2020. It has so far been reported in 53 countries, and the CDC says that it has lower susceptibility to the combination bamlanivimab-etesevimab monoclonal antibody treatment. This was enough for WHO to declare it a variant of interest.

Kappa

First documented in India in October 2020, kappa is also considered a variant of interest by WHO. The CDC says that this variant may reduce the neutralisation potential of some monoclonal antibody treatments. It has been reported in 55 countries.

Lambda

First identified in Peru in December 2020, lambda became the dominant variant within three months, accounting for 80% of all cases. The swiftness and presence of mutations that could affect transmissibility and antibodies’ effectiveness have made it a variant of interest for WHO. It has been detected in 41 countries but has not yet outcompeted any of the more dominant variants.

No peer reviewed studies of lambda have been conducted, but early preprint studies indicate some reduction in neutralising antibody effects from the CoronaVac (Sinovac) vaccine,¹⁸ as well as Pfizer and Moderna, although researchers say that they are confident that the latter two would remain protective.¹⁹

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