Since early 2020, SARS-CoV-2 has spread rapidly throughout the world1, profoundly changing the way we live our lives. With almost constant news coverage and an unprecedented number of journal articles being published on the virus2, keeping up can be extremely difficult. As vaccines begin to be rolled out around the world3, there are a few important questions to answer that will determine when the pandemic can finally end. These questions are:

* Can I be reinfected?
* What is a variant?
* Should we worry about new variants?

To answer this first question, we need to look at some data. So far there has only been 4 confirmed cases of reinfection4 out of 115 million cases1. This does not show us the full picture though, as there may be many more unconfirmed cases of reinfection. Even with this caveat in mind, however, a recent study on hospital staff in the UK between June and November 2020 found that in the group who had been previously infected with SARS-CoV-2 only 0.67% of individuals tested positive again, compared to the previously non-infected group where 2.9% of individuals tested positive6. This equates to an 83% reduction in the risk of infection for those who have previously had SARS-CoV-2.

When we compare the 83% reduction in risk of infection (which can also be referred to as efficacy) to that of the vaccines being rolled out at the moment we can see that they are all very similar7,8. While these values are not directly comparable9, the fact that they are all relatively high shows that they all provide a significant reduction in risk of infection.

In important question to ask then, is the effect of variants on the immunity gained from vaccination or infection.

Before we can answer this question, however, it is important to understand what a variant actually is. A variant is defined as a virus whose genomic sequence varies from that of the reference virus10. In the case of SARS-CoV-2 the reference virus is the one that was sequenced in Wuhan back in January 202011. It is worth noting that a strain, however, is a variant that possess new, unique and stable characteristics12. For a new strain to arise a variant would have to have a very large number of mutations. This is well demonstrated by the **380** amino acid substitutions (which is a proxy for genetic differences) between the sister strains SARS-CoV and SARS-Cov-213. Considering that there are only 17 amino acid substitutions between the Brazil, P.1 variant virus and the reference virus14, it is plain to see we are a very long way from having a new SARS strain.

Now we know what a variant is, should I worry about them?

This question is best answered in two parts: the short-term and the long-term threat variants pose.

In the short-term, in susceptible populations, new variants **with** increased transmissibility do pose a threat. This is as more, unprotected vulnerable people may be infected with the virus, increasing the number of hospitalisations and therefore deaths15. So far, the UK variant and the South African variant have some epidemiologicaland experimental evidence to suggest an increase in their increased transmissibility16,17,18.

When we look to the threat posed by variants in the long-term, things become a lot less clear. On the one hand some studies have suggested that the South African and Brazil variants may be resistant to the neutralizing antibodies that prior infection and immunisation provide19,20,21.

However, even if we take an unrealistic view that all variants drastically reduce vaccine efficacy, it may not be anything to worry about. You see, all these studies have only tested the variants resistance to neutralizing antibodies and have ignored T cells.

While neutralizing antibodies, which are produced by B cells, bind to molecules on the surface of a virus, like the spike protein, and therefore prevent it from binding to human cells, T cells recognise cells that have been infected and kill them or activate other immune cells to kill them22. This means that while they do not prevent infection, they can still reduce the severity of it.

A recent preprint has found that the UK, South African, Brazilian and Californian variants all have negligible effects on the response of T cells23 in individuals who have been vaccinated or previously infected meaning that, irrespective of a variant’s resistance to neutralizing antibodies, vaccination or prior infection is likely to reduce disease severity.

On top of this vaccines can be easily tweaked to provide protection against new antibody resistant variants24. These vaccines could be distributed every year to the most vulnerable, much like flu vaccines are.

To summarise:

* While reinfection may occur, it is likely to be very rare.
* A variant is a virus whose genomic sequence varies from that of the reference virus
* Variants may pose a threat in the short-term in an unvaccinated population, but in the long-term are unlikely to be a significant threat in a vaccinated population due to T cells and the ability to easily tweak vaccines.

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