The natural evolution of SARS-CoV-2: how science responds to these challenges

Novel variants of SARS-CoV-2 may change the rates of transmissibility and severity of COVID-19. Continued surveillance is the best approach to understanding the extent of change in these variants, and to preparing new strategies to overcome them.

The origin of the virus variants – is the SARS-CoV-2 virus unusual?

- Virus variants are natural and arise from mutations during viral replication.
- The average mutation rate of SARS-CoV-2 remains low and steady and is much slower than other RNA viruses, such as influenza viruses.
- Despite this, recent SARS-CoV-2 variants have spread rapidly across the world and many more are expected to develop.
- Most COVID-19 vaccines target the spike protein so mutations might compromise the immune response.
- These variants have mutations in the spike protein, which they use to enter human cells, but it is also where neutralising antibodies bind to block the SARS-CoV-2 infection.

What are the implications of the emerging SARS-CoV-2 variants on the efficacy of the COVID-19 vaccines?

- *In vitro* studies and data from clinical trials are helping researchers to understand how the efficacy of the vaccines is affected.
- As several antibodies and T cells are produced against different parts of the spike protein, it is believed that the current vaccines will maintain some protection.

What are the strategies to overcome vaccine escape?

- Changing the vaccine administration regimen (e.g. an additional booster vaccine dose).
- Optimising the original vaccine to match the variant; direct changes to the vaccine can be performed relatively quickly but further steps will be required to ensure quality, safety and effectiveness of the new vaccine(s).
- Surveillance data on emerging variants are being continuously collected to ensure that the best vaccine strategy is being employed.
- Should new variants begin to become dominant amongst the viruses circulating, adaptation of existing vaccines and investigation into combining different vaccine platforms will likely be needed.

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Antibodies induced by vaccination or previous exposure to a virus may not be fully neutralised

Antibodies induced by vaccination or previous exposure to a virus

The binding of neutralising antibodies to a virus variant may differ from their binding to the original virus