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COVID-19 Variants of Concern and Canada's Immunization Efforts

Fact Sheet

May 20, 2021

Summary: A number of new COVID-19 variants of concern have recently been identified in Canada during 2021, leading to concerns about increased transmissibility, potentially worsened disease severity and resistance to existing vaccines.

How immunity after vaccination works: The immunity to the coronavirus we develop following vaccination or infection is largely due to the development of antibodies that bind to the receptor-binding domain (RBD). The RBD is a key part of a virus located on its spike domain that allows the virus to dock to body receptors and gain entry into cells, leading to infection.

Some mutations of concern in new variants

N501Y: Using the spike protein is how the coronavirus enters cells, and N501Y is in an especially important region called the receptor-binding domain, which latches on to the cell. An N501Y mutation may make the spike protein stickier, allowing it to bind to and enter cells more readily.

D614G: This strain of coronavirus dominates because it increases the spike protein's ability to open cells for the virus to enter. The D614G mutation causes a flap on the tip of one spike to pop open, allowing the virus to infect cells more efficiently.

E484K escape mutation: Mutations in the spike domain of the virus can allow the virus to evade, or partially evade, antibodies. This is the reason they are called "escape mutations".

Current status: More than 70,000 cases of variants have been confirmed in Canada, with most cases in Ontario, Alberta, B.C., Quebec and Saskatchewan (April 20, 2021). B117 is the most prevalent variant of concern. For cumulative data on the variants of concern, including national and provincial figures, please reference [PHAC's Epidemiological Summary: Table 2](#).

B117 (UK/Kent variant)

- First detected in September 2020 in Greater London, UK region.
- First detected in December in Ontario; now found in all Canadian provinces.
- **Transmissibility rate increase:** averages 50% (CDC)
- **Why it spreads:**
 - One analysis found that more than a third of patients infected by B117 had high viral loads.
 - N501Y: Because of the N501Y mutation, B117 strain may also be 'stickier', or better able to grab onto the cells that it infects.



- D614G: Allows B117 to enter cells more effectively, giving it the ability to spread more quickly than the original predominant virus.
- E484K: some strains of B117 contain this mutation.
- **Risk of severe illness:** In January 2021, scientists from the UK reported evidence that suggests the B117 variant may be associated with an increased risk of death, compared with other variants. According to UK researchers, it is estimated to be from 30% up to 100% more fatal. Ontario data released at the end of March 2021 found that variants (with most variants of concern in Ontario and Canada being B117) substantially increase the risk of serious illness, when compared to the initial strain of SARS-CoV-2, including:
 - 60% increased risk of hospitalization;
 - 100% increased risk of being admitted to an ICU;
 - 60% increased risk of death.
- **Vaccine efficacy:** Because B117 and the most prevalent strain share 99% of the same proteins, both the Moderna and Pfizer-BioNTech vaccines will likely still be effective against the variant. Preliminary analysis in a UK trial of the AstraZeneca vaccine and the real-world evidence suggests the AstraZeneca vaccine provides a similar level of protection against the UK variant as it did against the original variant.

B1351 (South African variant)

- First detected in October 2020 in Nelson Mandela Bay, South Africa
- Based on the UK variant
- **Transmissibility rate increase:** averages 50% (South African data)
- **Why it spreads:**
 - N501Y: Because of the N501Y mutation, the strain may also be 'stickier', or better able to grab onto the cells that it infects.
 - D614G: Allows B1351 to enter cells more effectively, giving it the ability to spread more quickly than the original predominant virus.
- **Risk of severe illness:** Currently there is no evidence to suggest that this variant has any impact on disease severity.
- **Vaccine efficacy:**
 - This variant has multiple mutations in the spike protein, including the escape mutation E484K.
 - A laboratory study suggests that the South African variant of the coronavirus may reduce antibody protection from the Pfizer/BioNTech vaccine by two thirds, and it is not clear if the shot will be effective against the mutation, the companies have said. The study found the vaccine was still able to neutralise the virus, and there is not yet evidence from trials in people that the variant reduces vaccine protection, particularly against severe illness. The company is making investments and talking to regulators about developing an updated version of their mRNA vaccine, or a booster shot, if needed.

P1 (Brazilian variant)

- First identified in January 2021 in travelers from Brazil who arrived in Japan
- Based on the UK variant
- **Transmissibility rate increase:** highly transmissible (rate unknown)
- **Why it spreads:**
 - N501Y: Because of the N501Y mutation may also be 'stickier', or better able to grab onto the cells that it infects.

- D614G: Allows P1 to enter cells more effectively, giving it the ability to spread more quickly than the original predominant virus.
- The P1 variant also has 17 unique mutations, including three in the receptor-binding domain of the spike protein; one is the escape mutation E484K.
- **Risk of severe illness:** Currently there is no evidence to suggest that this variant has any impact on disease severity.
- **Vaccine efficacy:** More research is needed.

B.1.617 (Indian variant)

- First detected in India in February 2021, it has now been detected in over 40 countries, including in Canada.
- **Transmissibility rate increase:** Estimated at 225% increase, compared to original SARS CoV-2 strain
- **Why it spreads:**
 - D614G: Allows variants to enter cells more effectively, giving it the ability to spread more quickly than the original predominant virus.
 - E484Q: In addition to multiple mutations, the substitution in E484 means the virus binds well to the spike protein and is better at evading the host's immune system
- **Risk of severe illness:** More research is needed.
- **Vaccine efficacy:** More research is needed.

Will the existing vaccines work?

Evidence suggests that the available COVID-19 vaccines may still produce some protective immune response against the new variants identified, even when the escape mutation is present. Changes to the vaccine can be made to target variants of concern and will likely be needed as certain new variants become dominant amongst the viruses that are circulating.

Strategies devised to overcome a potential decrease in vaccine efficacy

- The vaccine administration regimen can be modified to increase the overall immune response and, ideally, provide more protection against new variants (e.g., an additional booster vaccine dose can be considered).
- Optimisation of the original vaccine, such as the development of a new version with an updated spike protein, is also possible.
- To determine whether either of these approaches are required, surveillance data on emerging variants are being collected to ensure that the best vaccine strategy is being employed.
- As new variants continue to spread, it is more important than ever that existing public health measures – masking, physical distancing, hand-washing, cleaning protocols and ventilation – be maintained and even potentially enhanced, even as the vaccine rollout continues across Canada.