COVID-19 Variant of Concern Omicron (B.1.1.529): Risk Assessment, December 1, 2021

12/1/2021

Key Messages

- Lineage B.1.1.529 of the Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) was designated a variant of concern (VOC), Omicron, by the World Health Organization (WHO) on November 26, 2021.\(^1\)

- The detection of Omicron in South Africa coincided with rapid increases in COVID-19 incidence and positivity rates there,\(^2,5\) where only 24% of its eligible population is fully vaccinated.\(^6\)

- Omicron carries the highest number of novel mutations documented, compared to other VOCs.\(^7\) The significance of these mutations is not yet clear;\(^6,9\) however, some of the mutations have been associated with immune escape, transmissibility, and susceptibility to monoclonal antibody treatment.\(^10\)

- As of December 1, 2021, seven cases of Omicron had been detected in Canada.\(^11-14\) At this point in time, the risk of Omicron importation in Ontario is high and the risks of further transmission, severe disease, reinfection, and breakthrough infection in Ontario is moderate with a high degree of uncertainty. The overall risk assessment may change as new evidence emerges.

Issue and Research Question

- The first known confirmed Omicron positive specimen globally was collected on November 8, 2021 in South Africa,\(^4\) although the precise timing and location of Omicron emergence are not yet known.\(^1\)

- Prior to being designated a VOC, the B.1.1.529 lineage was designated a Variant Under Monitoring by the World Health Organization (WHO) on November 24, 2021.\(^15\) In the United Kingdom (UK), it was designated a Variant Under Investigation (VUI-21-NOV-01) on November 25, 2021.\(^10\)

- A number of countries have implemented travel-related restrictions for travellers arriving or seeking to depart from southern African countries (including at time of writing Canada, the United Kingdom, Germany, France, Italy, the Netherlands, Austria, Belgium, Malta, the Czech Republic, Dubai).\(^3,17-19\) However, as is the case for Canada, additional countries have been added to the initial group affected by measures due to the still limited understanding of the timing and location of Omicron emergence (i.e., Nigeria). WHO has warned against travel bans as being unlikely to be effective and advised that individuals over 60 years of age who are not fully vaccinated or do not have proof of previous SARS-COV-2 infection and those with underlying health conditions should postpone travel.\(^20\)
This evidence brief updates the Public Health Ontario (PHO) report from November 29, 2021 and summarizes available information and evidence on the Omicron VOC relevant to the risk of importation and transmission in Ontario.

**Methods**

From January 17 to December 1, 2021, PHO Library Services conducted daily searches of primary and preprint literature using the MEDLINE database (search strategies available upon request). In addition, PHO performed grey literature searches daily using various news feeds and custom search engines. English-language peer-reviewed and non-peer-reviewed (preprint) records that described COVID-19 variants were included.

**Genomic Features**

- Omicron has over 50 mutations including 32 mutations on the spike protein.\(^{10}\)
  - Some of the mutations identified in Omicron are also found in other VOCs,\(^{23}\) and may be associated in theory or through functional studies of previous variants with immune escape, enhanced transmissibility via inducing cell fusion, and susceptibility to treatment.\(^{10,24,25}\)
  - Three mutations (P681H, H655Y, N679K) around the s1/s2 furin cleavage site may be associated with increased infectivity.\(^{26}\)
  - Three mutations (Δ69-70, T95I, G142D/Δ143-145) in the N-terminal domain may be associated with evasion of antibody neutralization by innate, vaccine-based, or monoclonal-based antibodies, as well as increased infectivity.\(^{25}\)
  - Three mutations of the receptor-binding domain, T478K (also found in Delta), N501Y (also found in Alpha, Beta and Gamma), and Q498R (not previously found in VOCs), may increase the binding affinity of the virus to the ACE2 receptors on host cells and may ultimately have higher infectivity (ref 23,24).\(^{26,27}\)
  - Outside of the spike protein, the nsp6 deletion Δ105-107 (also found in Alpha, Beta, and Gamma VOCs) may be associated with further evasion of innate immunity.\(^{28}\)
  - Two mutations of the nucleocapsid, R203K and G204R (also found in Alpha and Gamma VOCs), may be associated with increased infectivity.\(^{29}\)

**Epidemiology**

- As of December 1, 2021, Omicron cases have been reported by 27 countries.\(^{12-14,30-39}\)
  - Africa: South Africa (183),\(^4\) Botswana (19),\(^{40}\) Nigeria (3)\(^{35}\)
  - Americas: Brazil, Canada (7),\(^{11-14}\) United States (1)\(^{34}\)
Asia: Hong Kong (4), Israel (1), Japan (1), Saudi Arabia, South Korea (5)

Oceania: Australia (4)

Europe: Austria (3), Belgium (2), Czech Republic (1), Denmark (4), France (1), Germany (9), Ireland (1), Italy (4), the Netherlands (16), Norway (2), Portugal (14), Spain (2), Sweden (3), Switzerland, United Kingdom (32)

Since its first detection from a specimen collected on November 8, 2021, Omicron has replaced Delta as the dominant variant at 74% (183/249) of genomes sequenced in South Africa.

The reported number of Omicron cases is anticipated to continue to rise as countries ramp up detection and surveillance for the novel variant.

Transmissibility

It is as yet unclear if Omicron is more transmissible than other VOCs.

The estimated effective reproductive number (Re) in South Africa for COVID-19 on November 18, 2021 ranged from 1.38-1.65 for all provinces, with the exception of Gauteng which had a high number of Omicron cases and an estimated Re of 2.33 (Omicron was not distinguished from other variants when calculating Re's).

Disease Severity

Where information on disease severity is available, cases were either asymptomatic at the time of testing or reported only mild symptoms.

Vaccine Effectiveness

It is unclear if and to what extent Omicron can evade immunity from prior infection and vaccination.

Only 24% of the population in South Africa, one of the countries experiencing an increase in Omicron cases, has been fully vaccinated, and it is unknown at this time how many of the infected cases have been vaccinated.

Both the Moderna Spikevax and Pfizer-BioNTech Comirnaty COVID-19 vaccines are expected to continue to provide protection against Omicron, but studies are currently underway to determine to what degree vaccine efficacy will be impacted. Based on the mutations present in Omicron, vaccine manufacturers predict existing COVID-19 vaccines to be less effective against the emerging Omicron variant.

There are media reports of breakthrough infections of B.1.1.529 in Botswana, Hong Kong, Israel, Japan, South Korea and the United States.

As of November 27, there are also reports of 61 out of 624 passengers from South Africa who tested positive for COVID-19 on arrival to Amsterdam, including 14 infected with Omicron. The Netherlands requires proof of vaccination or a negative test for entry.
Reinfection

- WHO reported preliminary evidence of increased risk of COVID-19 reinfection with Omicron, likely based on the increasing incidence of COVID-19 in almost all provinces in South Africa.\(^1\)

Diagnostic Assays

- Current molecular and antigen tests for SARS-CoV-2 are expected to be able to detect Omicron.

- Considering that the vast majority of COVID-19 cases in Canada are due to Delta (99.9% in Ontario from October 17 to November 13, 2021),\(^49\) markers suggestive of a non-Delta infection may be implemented to screen for the presence of Omicron. S gene target failure (SGTF) in one widely used polymerase chain reaction (PCR) test can be used as a marker for Omicron while pending confirmation by sequencing.\(^1\) Sequencing is required as SGTF is not specific to Omicron, and is found in other variants. Other screening methods employing PCR to target specific mutations (e.g. Δ69/70, N501Y), as implemented for other VOCs, may also be used to identify a possible Omicron infection pending further sequencing.

Ontario Risk Assessment

- The current risk of Omicron importation in Ontario is high and the risks of further transmission, reinfection, or breakthrough infection in Ontario is moderate with a high degree of uncertainty.

- As of December 1, 2021, four cases of confirmed Omicron had been detected in Ontario. Ontario’s proportionate whole genome sequencing (WGS) surveillance is expected to detect a variant at a prevalence of 1% for samples with a cycle threshold (Ct) value ≤30 and sufficient volume remaining. Of note, the Ontario COVID-19 Genomics Network moved from sequencing 25% of eligible samples on October 8 to 100% on November 5, 2021. Ontario’s Re is above 1 (i.e. epidemic growth is occurring), with multiple local surges while Delta remains the dominant strain.\(^50,51\)

- In terms of the risk of importation, federal travel-related restrictions were implemented after Omicron was known to have been circulating in southern Africa,\(^52\) and the list of affected countries has expanded quickly. The overall risk assessment may change as new evidence emerges (see Table 1).

- Further epidemiological and laboratory studies are in progress to assess if Omicron confers any additional phenotypic impacts based on its extent of novel mutations (e.g., change in transmissibility, disease severity, or antibody evasion from innate immunity, vaccines, and/or therapeutics).
Table 1. Risk Assessment for Omicron B.1.1.529

<table>
<thead>
<tr>
<th>Issue</th>
<th>Risk Level</th>
<th>Degree of Uncertainty</th>
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<tbody>
<tr>
<td>Importation in Ontario</td>
<td>High</td>
<td>Low</td>
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<tr>
<td>Increased Transmissibility</td>
<td>Moderate</td>
<td>High</td>
</tr>
<tr>
<td>Disease Severity</td>
<td>No information</td>
<td>High</td>
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<tr>
<td>COVID-19 Re-infection</td>
<td>Moderate</td>
<td>High</td>
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<tr>
<td>Lowered Vaccine Effectiveness/Breakthrough Infections</td>
<td>Moderate</td>
<td>High</td>
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<tr>
<td>Impacts on Testing/Surveillance</td>
<td>Low</td>
<td>Low</td>
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</tbody>
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Implications for Practice

- Emerging evidence and information on Omicron is evolving, and close monitoring to inform the public health response in Ontario is needed. Of note, this summary reflects publicly available information current to December 1, 2021.

- VOC PCR testing in Ontario, previously implemented but discontinued as of November 12, 2021, has been rapidly leveraged to enhance the ability to identify suspected Omicron cases from travellers to affected countries through the detection of SGTF (Δ69-70) on the TaqPath assay.53

- Noting concerns about Omicron’s potential increased transmissibility and mutations that may have implications for vaccine/immune escape, as well as uncertainty about its virulence (i.e., clinical severity among those with disease), as a precautionary approach a temporary containment strategy could help delay importation and spread of this VOC in Ontario.

- In addition to federal travel-related restrictions and requirements for returning travellers, a containment strategy in Ontario requires rapid consideration and implementation of enhanced public health measures, including case and contact management approaches. Given the rapid and ongoing expansion of countries where Omicron has been detected to date, including jurisdictions outside of southern Africa, a cautious approach to enhanced measures in Ontario could consider any recent travel outside Canada (including but not limited to countries/regions with confirmed Omicron cases) as potential increased risk for Omicron acquisition.

- Population-level and individual-level public health measures should continue to be implemented to help limit the spread of COVID-19 in Ontario using a multi-layered approach, including vaccination, masking, physical distancing, ventilation, hand washing, and staying home when sick or with any symptoms of COVID-19.54

- Vaccination remains one of the most effective layers of protection against SARS-CoV-2, including for Delta strains currently representing 99.9% of the COVID-19 disease burden in Ontario. Global efforts to optimize vaccination uptake and coverage, especially in low and middle income nations that have limited resources to prevent and control COVID-19 transmission, is also a key measure to reduce VOC spread as each transmission event plays a role in fostering mutations of the virus that risk the development of further variants.54
References


