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COVID-19: Variants of Concern

Dr. Michelle Murti

Dr. Jonathan Gubbay

Sandra Callery

March 31st, 2021

PHO Grand Rounds

Disclosure Statement

- None of the presenters at this session have received financial support or in-kind support from a commercial sponsor.
- None of the presenters have potential conflicts of interest to declare.

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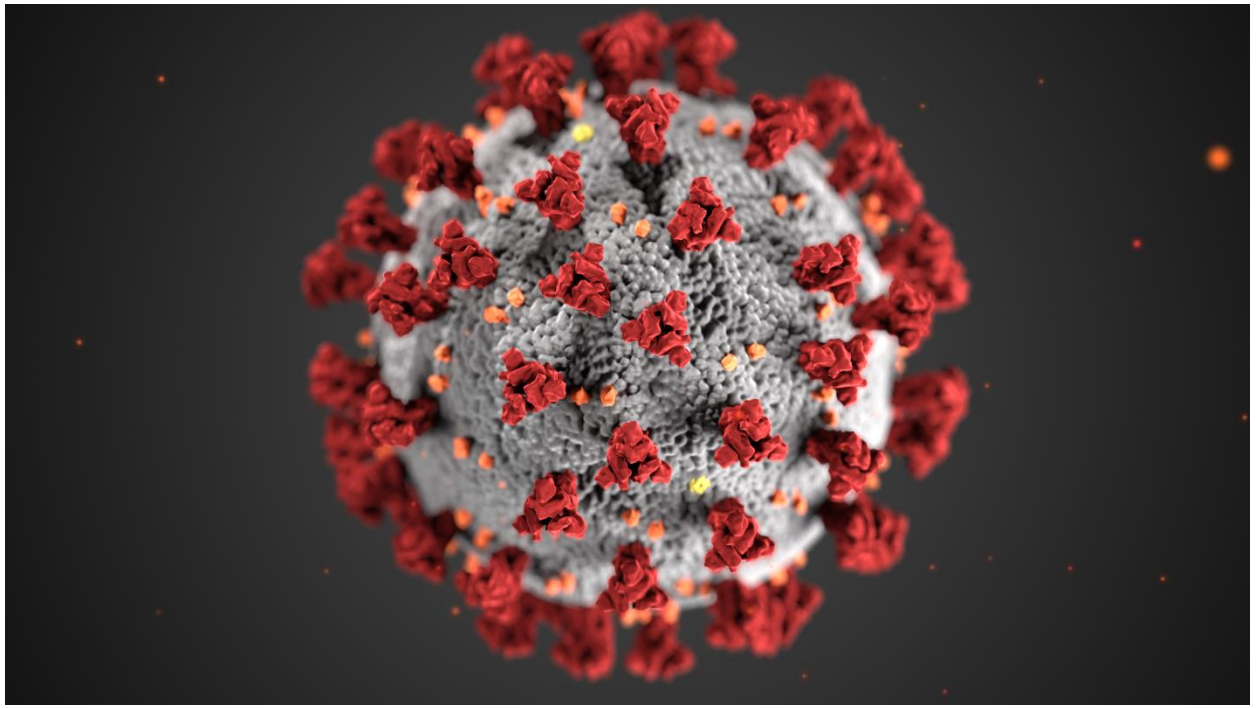
Objectives

- Describe the variants of concern for COVID-19 and their role in the pandemic;
- Describe the laboratory testing process associated with variants of concern in Ontario;
- Describe the infection prevention and control measures recommended for variants of concern.

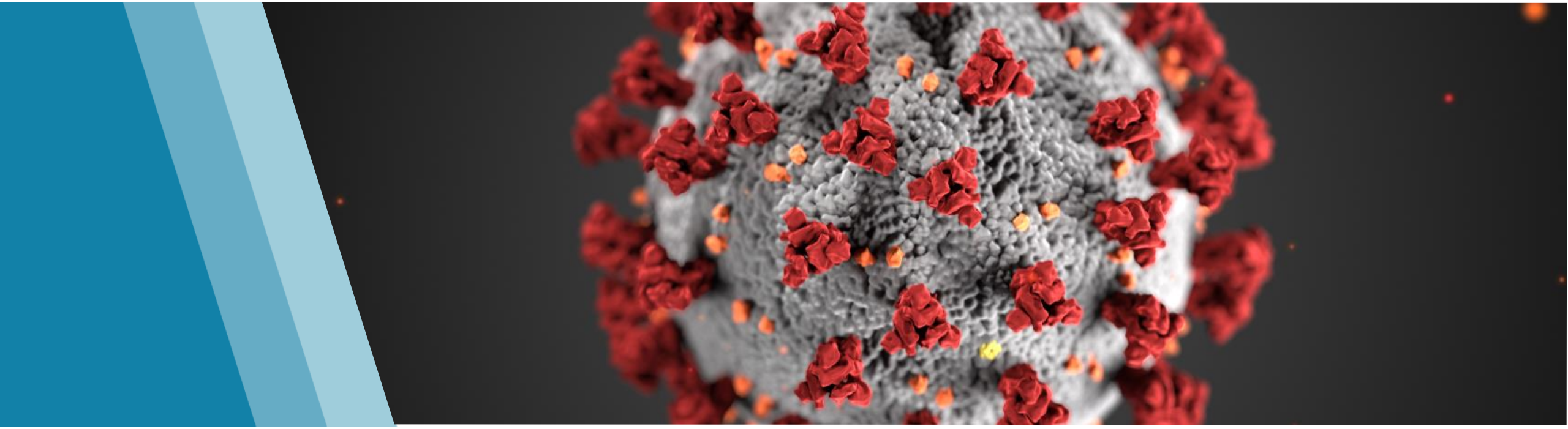
Polling Question #1

- What proportion of COVID-19 cases in Ontario are likely to be a variant of concern?

- A: <1%
- B: 1-19%
- C: 20-39%
- D: 40% or more
- E: don’t know



Variants of Concern in Ontario and Internationally



What is a “Variant of Concern” or VOC?

- Viruses constantly change through mutation
- A variant has one or more mutations that differentiate it from other variants in circulation
- “A variant for which there is evidence of an increase in **transmissibility**, more **severe disease** (increased hospitalizations or deaths), significant **reduction in neutralization by antibodies** generated by previous infection or vaccination, **reduced effectiveness of treatments or vaccines**, or **diagnostic detection failures**.”

Source: Centers for Disease Control and Prevention. SARS-CoV-2 variant classifications and definitions [Internet]. Atlanta, GA: Centers for Disease Control and Prevention; 2021 [modified 2021 Mar 24; cited 2021 Apr 15]. Available from: https://www.cdc.gov/coronavirus/2019-ncov/cases-updates/variant-surveillance/variant-info.html

Multiple Variants have Emerged Since the Pandemic

- Shift from A to B lineage (and now R, P, D)
- Multiple independent introductions of common mutations, e.g., N501Y, E484K
- Spike protein gene – mutation nomenclature example
  - Original: 484 position – “G-A-A”, code for glutamic acid (“E”)
  - Mutation: 484 position – “A-A-A” , code for lysine (“K”)
  - Mutation denoted as “E484K”

Source: Economist. It's a family affair: the same covid-19 mutations are appearing in different places. Economist [Internet], 2021 Feb 27 [cited 2021 Apr 15]; Graphic detail. Available from: https://www.economist.com/graphic-detail/2021/02/27/the-same-covid-19-mutations-are-appearing-in-different-places

Designated VOCs

- B.1.1.7 (501Y.V1) - Originally identified in the United Kingdom[1]
  - Demonstrated increased transmissibility (~43-82%),[2] increased risk of hospitalization and death[3]
  - Relatively preserved immune response and vaccine efficacy[4]
  - B.1.351 (501Y.V2) - Originally identified in South Africa[1]
  - Increased transmissibility (~50%) but impact on severity less well established
  - Reductions in vaccine efficacy and immune response evasion[5-6]
- P.1 (501Y.V3) - Originally identified in Brazil[7]
  - Changes to transmissibility and severity less well established
  - Reductions in vaccine efficacy and immune response evasion – but less so than B.1.351[8]

All Three VOCs Present in Ontario – as of March 28, 2021

Variant	Change in cases March 27, 2021	Change in cases March 28, 2021	Cumulative case count up to March 28, 2021
Lineage B.1.1.7	102	124	1,749
Lineage B.1.351	0	0	63
Lineage P.1	6	15	82
Mutation or non-VOC lineage detected*	711	585	18,907

Source: Ontario Agency for Health Protection and Promotion (Public Health Ontario). Daily epidemiologic summary: COVID-19 in Ontario – January 15, 2020 to March 28, 2021 [Internet]. Toronto, ON: Queen's Printer for Ontario; 2021 [cited 2021 Apr 15]. Available from: https://files.ontario.ca/moh-covid-19-report-en-2021-03-29.pdf

Growing Watch List…

- United States has declared two additional VOCs identified in California
  - B.1.427 and B.1.429
  - Do not contain N501Y or the E484K mutations; both contain L452R mutation
  - Show ~20% increased transmissibility
  - Moderate reductions in neutralization with convalescent and post-vaccination sera
- Several ‘Variants of Interest’
  - Have mutations/genetic markers that may potentially have clinical or epidemiological impacts
  - B.1.525 and B.1.526 (rapidly increasing in New York City)
  - P.2 – first identified in Brazil

Source: Centers for Disease Control and Prevention. SARS-CoV-2 variant classifications and definitions [Internet]. Atlanta, GA: Centers for Disease Control and Prevention; 2021 [cited 2021 Apr 15]. Available from: https://www.cdc.gov/coronavirus/2019-ncov/cases-updates/variant-surveillance/variant-info.html#Concern

Potential Mechanisms of Increased Transmissibility

- Increased ‘fitness’ of virus
  - Increased viral load and viral shedding[9]
  - Increased period of contagiousness[10]
- Changes to receptor binding affinity
  - Increased infectivity of N501Y if binds to Angiotensin-Converting Enzyme 2 receptor ~10 times more tightly[11]
- Immune evasion
  - Transmission despite prior natural immunity or vaccination[6,5]

VOCs versus Vaccines

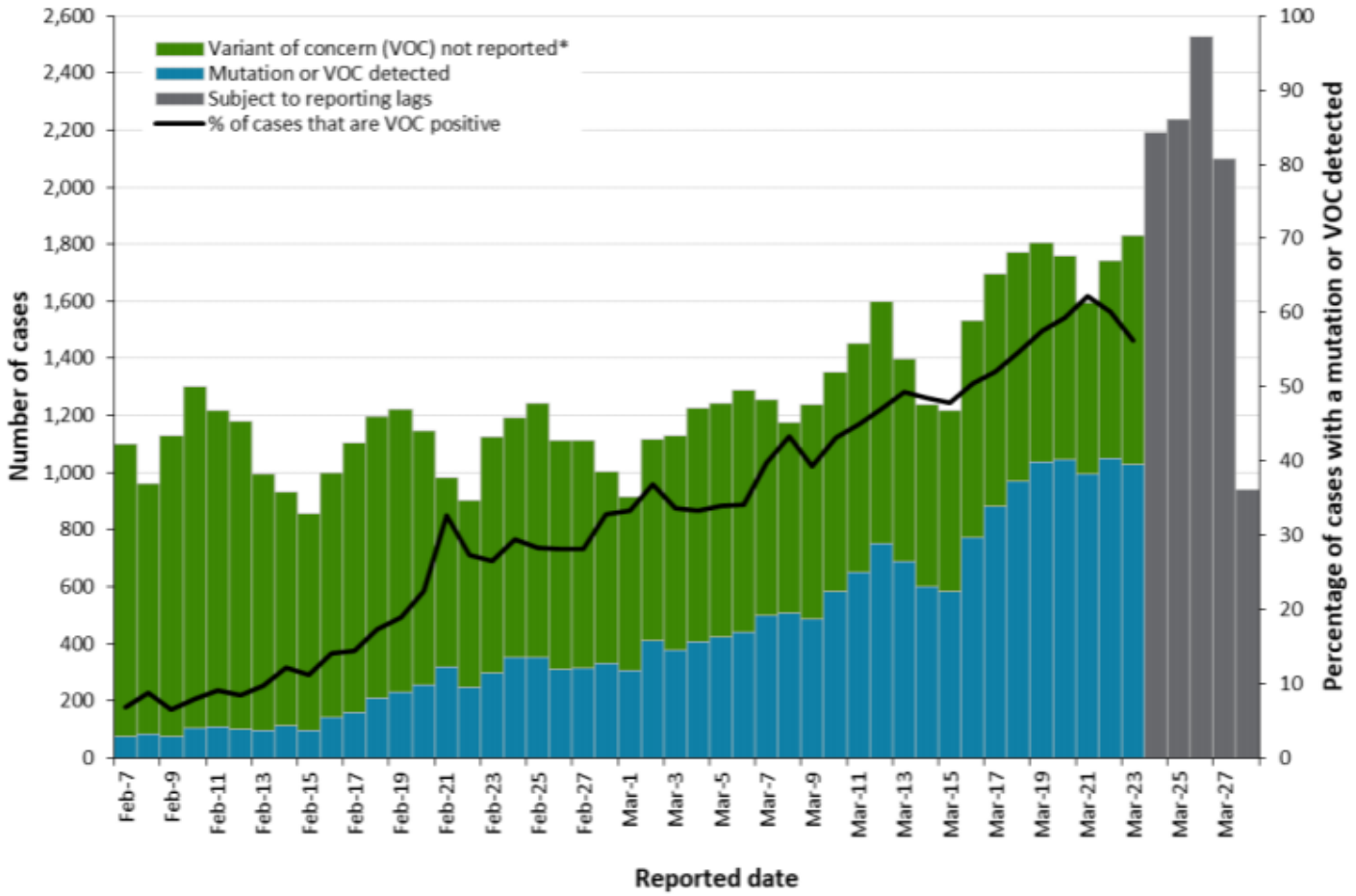
- Real-world studies of vaccine effectiveness in Israel (>40% B.1.1.7)
  - Pfizer reported 97% vaccine effectiveness in preventing symptomatic disease, severe/critical disease and death, and 94% against asymptomatic infection.[12]
- South Africa (>90% B.1.351) and Latin America (P.1 and P.2)
  - Johnson and Johnson reported vaccine efficacy against COVID-19 at 72% (US), 66% (Brazil), and 60% (South Africa).[13]
  - Novavax reported overall vaccine efficacy of 89% (United Kingdom) and 60% (South Africa).[14]
  - Astra Zeneca reported vaccine efficacy of 21.9% (95%CI -49.9 to 59.8) for mild-to-moderate infection in South Africa overall, and 10.4% (95%CI -76.8 to 54.8) for those with confirmed B.1.351.[5]

Vaccine Efficacy By VOC

- Clinical trial evidence:
  - Efficacy in preventing clinical infection (J&J: 66% ; Pfizer 95%)
  - Efficacy in preventing severe infection (J&J: 85%; Moderna 100%)
- In vitro evidence by neutralization assays:
  - Against B.1.1.7, B.1.351, P.1
  - Varying decreases by Pfizer and Moderna (N/A for other vaccines)
- Efficacy in settings with B.1.351 circulation
  - Lower for AZ, J&J, Novavax (N/A for other vaccines)

Source: Abdool Karim SS, de Oliveira T. Correspondence: new SARS-CoV-2 variants – clinical, public health, and vaccine implications. N Eng J Med. 2021 Mar 24 [Epub ahead of print]. Available from: https://doi.org/10.1056/NEJMc2100362

Rising Local Epidemiology – Ontario VOCs to March 28, 2021



- Rising case counts overall
- Rising percentage of cases with a mutation or VOC detected

Source: Ontario Agency for Health Protection and Promotion (Public Health Ontario). Daily epidemiological summary: COVID-19 in Ontario: January 15, 2020 to March 28, 2020 [Internet]. Toronto, ON: Queen's Printer for Ontario; 2021 [cited 2021 Apr 15]. Available from: https://files.ontario.ca/moh-covid-19-report-en-2021-03-29.pdf

Increased Transmissibility – Ontario Context

- Household secondary attack rates when index case is a VOC (mostly B.1.1.7) vs non-VOC.
  - Overall increase ~30% (consistent with findings from the United Kingdom).
  - Particularly higher secondary attack rates when the index case was asymptomatic (adjusted Risk Ratio 1.91 (95%CI 0.96-3.80) or pre-symptomatic (Adjusted Risk Ratio 3.41 (95%CI 1.13-10.26)).
- Comparing outbreak sizes by setting with any VOC case vs not (January 31 – March 13, 2021).

Setting	VOC or mutation not detected†			VOC or mutation detected† among at least one case linked to outbreak		
	N outbreaks	Median cases per OB (IQR)	Range	N outbreaks	Median cases per OB (IQR)	Range
Congregate Care	106	2(1-7)	1-71	38	8(2-15)	1-106
Congregate Living	246	1.5(1-3)	1-41	56	2(1-7)	1-82
Education	177	2(2-4)	1-40	97	4(2-7)	1-123
Other settings	290	3(2-6)	1-314	186	4(2-7)	1-59

*Unpublished data

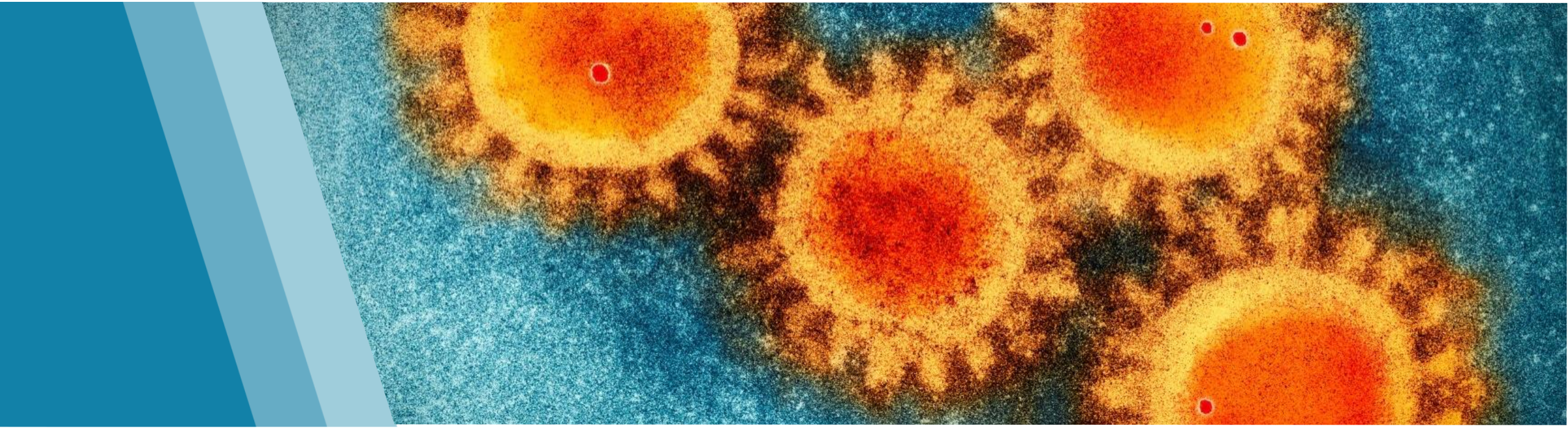
Source: Murti M, Gubbay J, Callery S (Ontario Agency for Health Protection and Promotion, Public Health Ontario). Conversation with: Buchan S, et al. (Ontario Agency for Health Protection and Promotion, Public Health Ontario, Toronto, ON). 2021 Mar 26.

Response to VOCs

- Limiting circulation of virus globally
  - Less virus replicating = less mutations
  - Strengthened and maintained public health measures
  - Rapid roll-out of vaccines (domestically and internationally)
- Limiting spread from cases infected with VOCs
  - Enhanced case and contact measures – increased transmissibility
  - Further measures for VOCs with vaccine escape potential?[15]
- Access to testing and surveillance for VOCs
- Real-world assessment of vaccine effectiveness against VOCs

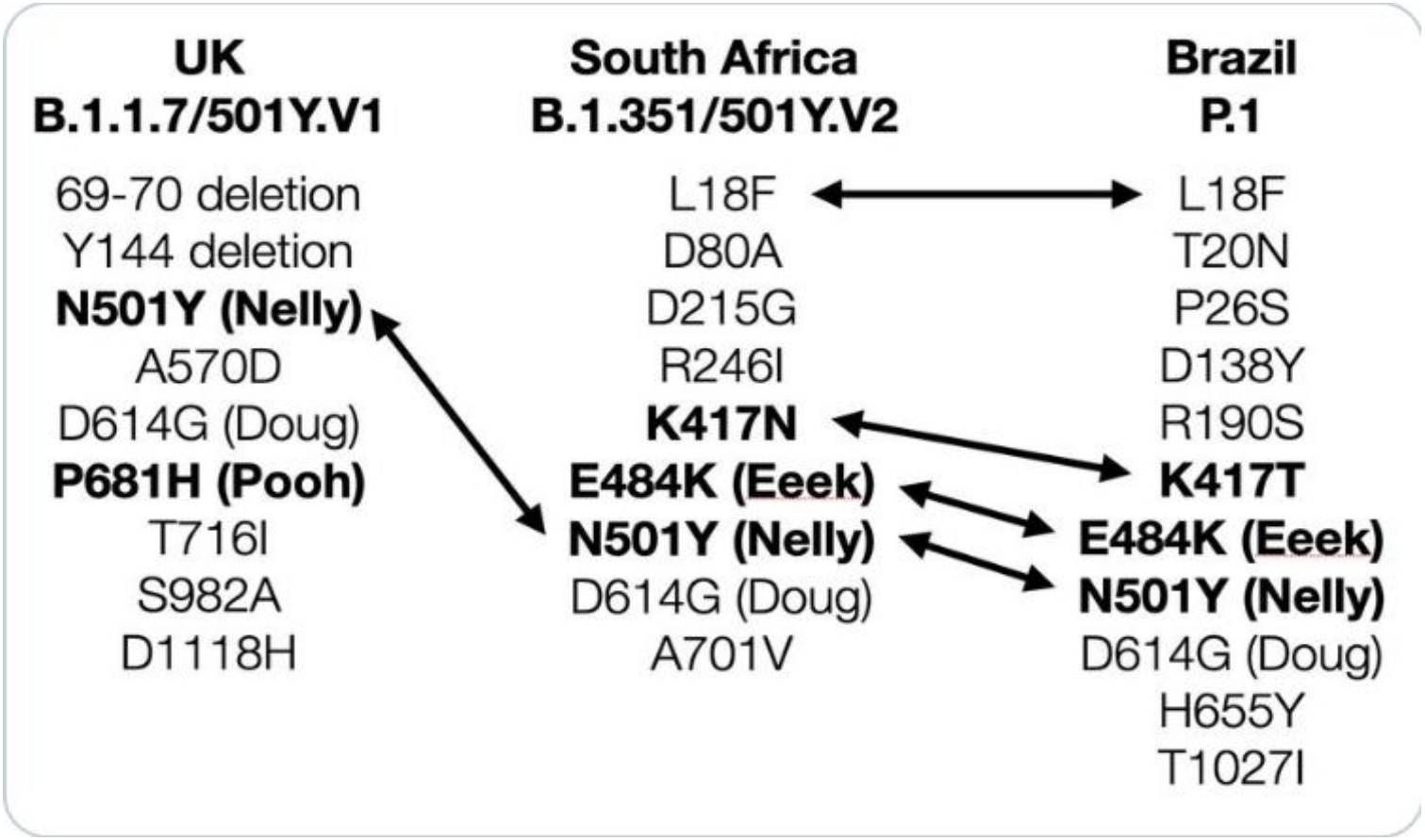
Source: European Centre for Disease Control and Prevention. Risk assessment: SARS-CoV-2 - increased circulation of variants of concern and vaccine rollout in the EU/EEA, 14th update [Internet]. Sweden: European Centre for Disease Control and Prevention; 2021 [cited 2021 Apr 15]. Available from: https://www.ecdc.europa.eu/en/publications-data/covid-19-risk-assessment-variants-vaccine-fourteenth-update-february-2021

Laboratory Testing for VOCs in Ontario



If You are Lost In Alphabet and Number Soup, Introducing…

- “Nelly” (N501Y)
- “Eeek” (E484K)
- “Pooh” (P681H)



Source: Anderson KG. Now the SARS-CoV-2 variants that were first identified in the UK (B.1.1.7), South Africa (B.1.351), and Brazil (P.1) have been found in the US, a couple of thoughts (i.e., speculation...) on what happens next, as I been getting many questions about transmission and immunity via @K_G_Andersen [Twitter]. 2021 Jan 30 [cited 2021 Apr 16]. Available from: https://twitter.com/k_g_andersen/status/1355689990487896065

Spike Mutations in B.1.427 and B.1.429

Name (Pango lineage)	Spike Protein Substitutions	Name (Nexstrain)	First Detected
B.1.427	L452R D614G	20C/S:452R	US - California
B.1.429	S13I W152C L45R D614G	20C/S:452R	US - California

Source: Centers for Disease Control and Prevention. SARS-CoV-2 variant classifications and definitions [Internet]. Atlanta, GA: Centers for Disease Control and Prevention; 2021 [cited 2021 Apr 15]. Available from: https://www.cdc.gov/coronavirus/2019-ncov/cases-updates/variant-surveillance/variant-info.html#Concern

Methods of Testing for VOCs

- S-gene target failure (SGTF)
- VOC real-time PCR testing – laboratory developed and commercial tests.
- Genome sequencing (Sanger or whole genome sequencing)

Methods of Testing for VOCs: S Gene Target Failure

- Caused by 69-70 spike deletion in B.1.1.7.
- Some molecular detection assays that target this region of Spike are affected.
  - Thermo Fisher Taqpath COVID-19 assay– N, ORF1ab unaffected; S target drops out.
  - NINGBO Health Gene Technologies SARS-CoV-2 Virus Detection Diagnostic Kit – targets ORF1ab gene, N gene and S gene.

S Gene Target Failure

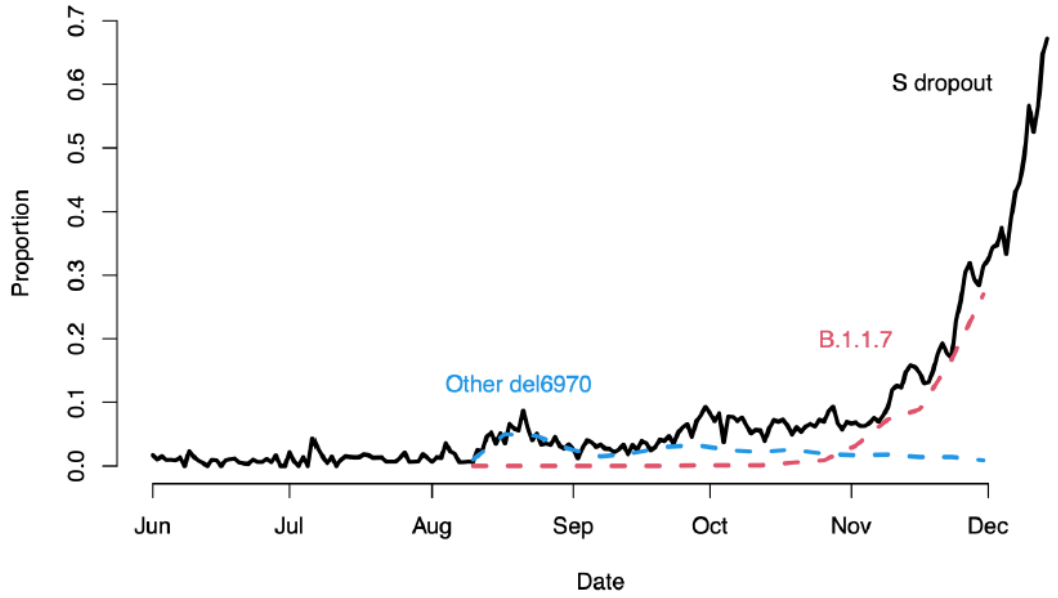


Figure 2. The solid black line shows the proportion of positive tests with S dropout at the Milton Keynes Lighthouse lab, the dashed red line shows the proportion of all Lighthouse sequences that are B.1.1.7, and the blue dashed line shows the proportion of sequences that are other variants with Δ69-70.

Investigation of novel SARS-COV-2 variant

Variant of Concern 202012/01

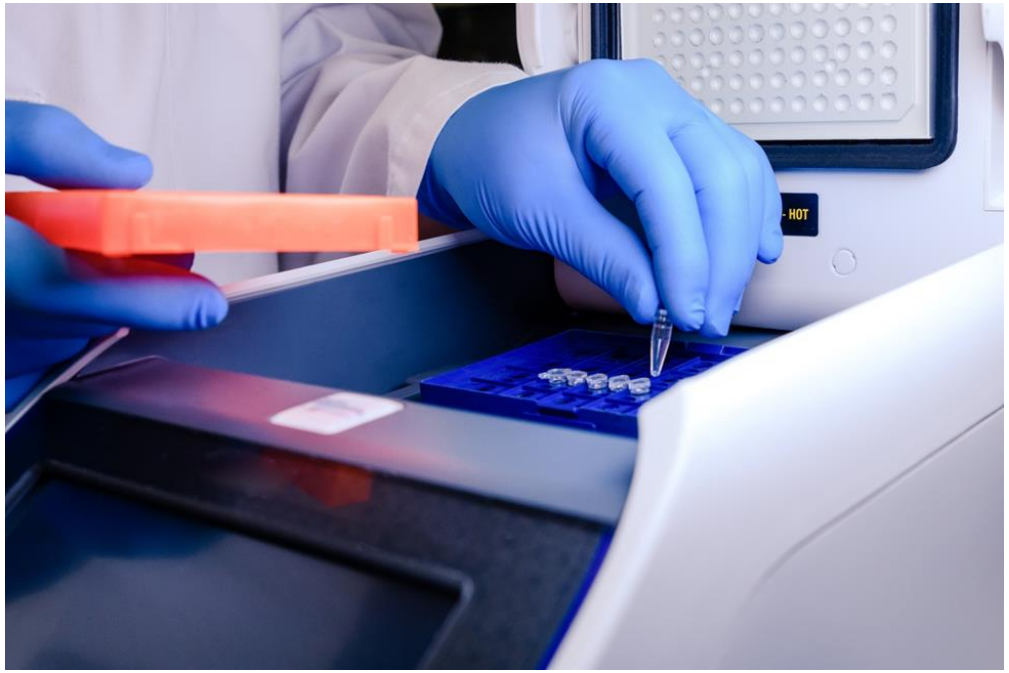
Week beginning	Percent new variant of all Δ69-70
2020-10-12	5%
2020-10-19	15%
2020-10-26	32%
2020-11-02	54%
2020-11-09	78%
2020-11-26	86%
2020-11-23	94%
2020-11-30	96%

Table 2. Percent of all Pillar 2 Δ69-70 sequences by week that are the new variant, B.1.1.7.

Source: Public Health England. Investigation of novel SARS-CoV-2 variant: variant of concern 202012/01 [Internet]. London: Crown Copyright; 2021 [cited 2021 Apr 15]. Available from: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/959438/Technical_Briefing_VOC_SH_NJL2_SH2.pdf. Used with permission available from: https://www.nationalarchives.gov.uk/doc/open-government-licence/version/3/

VOC N501Y single nucleotide polymorphism (SNP) real-time PCR

- VOC N501Y single nucleotide polymorphism (SNP) real-time PCR.
  - Requires SARS-CoV-2 detection PCR Ct to be ≤35 to ensure adequate viral load.
  - All SARS-CoV-2 positives screened since February 3.



Approach to surveillance for VOCs

- Canadian COVID-19 Genomics (CanCoGen) guidelines.
- Use of point prevalence by Ontario's COVID-19 Genomics Rapid Response Coalition (November 24, 2020).
- Use of point prevalence in ON (January 20, 2021).
- All positives approach (since February 3, 2021).
- Surveillance based approaches – a proportion (approx. 5%) of all non-VOC mutation samples undergo whole genome sequencing (WGS).
- Baseline surveillance using WGS since mid-2020.

Source: GenomeCanada. Canadian national COVID genomics surveillance priorities for existing and emerging variants of concern [Internet]. Ottawa, ON: GenomeCanada; 2020 [cited 2021 Apr 16]. Available from: https://www.genomecanada.ca/sites/default/files/canadian_national_covid_genomics_surveillance_priorities_for_existing_and_emerging_variants_of_concern.pdf

Criteria for VOC Screening - adapted from Canadian COVID-19 Genomics Network (CanCOGeN) Guidelines

- SARS-CoV-2 infection during international travel (including the United States) or within 14 days of entry to Canada.
- SARS-CoV-2-positive contacts of recent international travelers.
- SARS-CoV-2 positive contacts of cases with confirmed SARS-CoV-2 VOC infection.
- Suspected re-infection.
- Multitarget PCR assay e.g. Thermo Fisher (TaqPath), with S gene dropout (S gene negative) and other gene target/s positive with Ct <30.
- Severe (i.e. requiring ICU admission or ICU level of care) acute COVID-19 in individuals <50 years old without significant comorbidities.
- Vaccinated individuals with subsequent laboratory-confirmed SARS-CoV-2 infection >14 days after receipt of the second dose of vaccine (or >14 days after immunization series completion).
- Known or suspected super spreading events.

Source: GenomeCanada. Canadian national COVID genomics surveillance priorities for existing and emerging variants of concern [Internet]. Ottawa, ON: GenomeCanada; 2020 [cited 2021 Apr 16]. Available from: https://www.genomecanada.ca/sites/default/files/canadian_national_covid_genomics_surveillance_priorities_for_existing_and_emerging_variants_of_concern.pdf

Evolving Approach to VOC Testing in Ontario: dual target multiplex VOC real-time PCR

- N501, 501Y, E484K dual target multiplex VOC real-time PCR.
  - Implemented March 22, 2021
  - N501Y mutation positive, E484K negative specimens not tested further
    - Based on WGS data >95% of these are B.1.1.7
  - E484K mutation positive specimens (with or without N501Y) undergo WGS.
    - E484K Ct value must be ≤30 for adequate sequence quality. Report comment if Ct >30:
      - *"S gene mutation/s associated with SARS-CoV-2 VOCs present. No further testing will be performed due to a Ct >30, with unreliable sequencing above this threshold due to the limits of this technology in the context of low viral load."*

- At what prevalence threshold should routine VOC testing be reduced?

Dual Target Multiplex VOC Real-Time PCR Assay

Sample #:	21SL0017 (11022084)	**Date Collected:**	
Source:	Nasopharyngeal	**Date Received:**	2021-03-15
Testing Reason:		**Date Reported:**	2021-03-15
Specimen Note:	Date of Collection not provided on requisition, used Date of Receipt instead.		

Test	Result	Date Approved
SARS-CoV-2 VOC S Gene Mutation by SNP Multiplex RT-PCR	Detected	2021-03-15
N501Y S Gene Mutation	Detected	2021-03-15
E484K S Gene Mutation	Detected	2021-03-15
Interpretation	**SARS-CoV-2 N501Y and E484K S gene mutations associated with Variants of Concern (VOCs) DETECTED.**	2021-03-15

SAMPLE REPORT

Note: *For details about the assay, please see the test information sheet at the Public Health Ontario website: https://www.publichealthontario.ca/en/laboratory-services/test-information-index/covid-19-voc*

Copy of results sent to MOH.

Source: Public Health Ontario Laboratory, Public Health Ontario. Laboratory information system sample report [unpublished]. Toronto, ON: Queen's Printer for Ontario; 2021.

Dual Target Multiplex VOC Real-Time PCR Assay

Sample #:	21SL0019 (11022122)	**Date Collected:**	
Source:	Nasopharyngeal	**Date Received:**	2021-03-15
Testing Reason:		**Date Reported:**	2021-03-15
Specimen Note:	Date of Collection not provided on requisition, used Date of Receipt instead.		

Test	Result	Date Approved
SARS-CoV-2 VOC S Gene Mutation by SNP Multiplex RT-PCR	Unable to complete	2021-03-15
N501Y S Gene Mutation	Unable to complete	2021-03-15
E484K S Gene Mutation	Unable to complete	2021-03-15
Interpretation	Unable to screen for N501Y or E484K S gene mutations as SARS-CoV-2 virus was not detected with the multiplex VOC SNP assay.	2021-03-15

SAMPLE REPORT

Note: *For details about the assay, please see the test information sheet at the Public Health Ontario website: https://www.publichealthontario.ca/en/laboratory-services/test-information-index/covid-19-voc*

SARS-CoV-2 VOC S gene mutation screening could not be performed as no SARS-CoV-2 virus was detected in this specimen. This could be due to low viral load in the specimen, PCR inhibition, or other technical issues. Note that the multiplex VOC SNP assay is less sensitive than SARS-CoV-2 PCR detection assays.

Source: Public Health Ontario Laboratory, Public Health Ontario. Laboratory information system sample report [unpublished]. Toronto, ON: Queen's Printer for Ontario; 2021.

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LABSTRACT – March 2021

SARS-COV-2 (COVID-19 virus) Variant of Concern (VOC) Testing

Source: Ontario Agency for Protection and Promotion (Public Health Ontario). Labstract – March 2021: SARS-COV-2 (COVID-19 virus) variant of concern (VOC) testing [Internet]. Toronto, ON: Queen's Printer for Ontario; 2021 [cited 2021 Apr 21]. Available from: https://www.publichealthontario.ca/-/media/documents/lab/lab-sd-145-sars-cov-2-covid-19-variant-of-concern-testing.pdf?la=en

SARS-CoV-2 (COVID-19 Virus) Variant of Concern (VoC) Surveillance

SARS-COV-2 N501Y/E484K MUTATION TESTING BY REAL-TIME PCR

As of March 22, 2021, all COVID-19 PCR-positive specimens with Ct value ≤35* in Ontario will be tested fo the N501Y and E484K mutations using a multiplex real-time PCR assay. This test replaces the N501Y single target test that was implemented February 3, 2021. These two mutations are present in the more commonly described Variants of Concern (VOCs) as follows:

Variant of Concern	Mutation(s)[1]
B.1.1.7 (202012/01) (originally identified in the UK)	N501Y
B.1.351 (501Y.V2) (originally identified in South Africa)	N501Y, E484K
P.1 (originally identified in Brazil)	N501Y, E484K

[1]Only mutations detected by the VOC multiplex assay are listed.

Q and A document available at this location

Source: Ontario Agency for Health Protection and Promotion (Public Health Ontario). SARS-CoV-2 (COVID-19 virus) variant of concern (VoC) surveillance [Internet]. Toronto, ON: Queen's Printer for Ontario; 2021 [modified 2021 Mar 26; cited 2021 Apr 21]. Available from: https://www.publichealthontario.ca/en/laboratory-services/test-information-index/covid-19-voc

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SARS-CoV-2 VOC Genome Sequencing for Surveillance

As of March 22, 2021, only specimens positive for the E484K mutation (with or without the N501Y mutation) with Ct value ≤30* will be sequenced and reported for surveillance purposes. Specimens that are N501Y positive and E484K negative are presumed to be VOCs (likely B.1.1.7) based on current epidemiology, and will no longer be routinely sequenced to report the lineage.

Ongoing sequencing of all E484K-positive specimens will be revisited as needed.

A subset of SARS-CoV-2-positive specimens in which no mutations were detected by the real-time PCR will be selected for genome sequencing for surveillance purposes. For these, only aggregate results will be reported in PHO COVID-19 data and surveillance products to support ongoing monitoring of circulating lineages.

*** The specimen's VOC mutation testing PCR cycle threshold (Ct) value must be ≤30 for successful genome sequencing. A subset of samples with a CT ≤ 30 may not be successfully sequenced likely due to a low level of virus present, RNA degradation, or sequencing technical issues.**

Source: Ontario Agency for Health Protection and Promotion (Public Health Ontario). SARS-CoV-2 (COVID-19 virus) variant of concern (VoC) surveillance [Internet]. Toronto, ON: Queen's Printer for Ontario; 2021 [modified 2021 Mar 26; cited 2021 Apr 21]. Available from: https://www.publichealthontario.ca/en/laboratory-services/test-information-index/covid-19-voc

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Source:	Nasopharyngeal	**Date Received:**	2021-03-13
Testing Reason:		**Date Reported:**	2021-03-24
Specimen Note:	Date of Collection not provided on requisition, used Date of Receipt instead.		

Test	Result	Date Approved
SARS-CoV-2 Variant Detection by Sequencing	**Detected**	2021-03-24
N501Y	**Detected**	2021-03-24
K417N	Not detected	2021-03-24
E484K	**Detected**	2021-03-24
K417T	Not detected	2021-03-24
Interpretation	**SARS-CoV-2 B.1.351 VOC (emerged in South Africa) detected.**	2021-03-24

SAMPLE REPORT

Note: ***This laboratory developed investigational assay is being used for surveillance purposes, and is not a clinical test.*** *It involves PCR, followed by genome sequencing, including a 700 base pair (bp) fragment of the S gene (extending from amino acid P330 to N540). This fragment includes the receptor binding domain (RBD), where key VOC mutation/s are located.*

A key S gene mutation in the B.1.1.7 variant that emerged in the UK (N501Y) , several present in the B.1.1.7 variant that emerged in South Africa (K417N, E484K and N501Y), and several present in the P.1 variant that emerged in Brazil (K417T, E 484K and N501Y) are screened for with this assay.

This specimen contains SARS-CoV-2 virus with S gene mutation/s associated with SARS-CoV-2 B.1.351 VOC (emerged in South Africa), which was confirmed with further genome sequencing.

Source: Ontario Agency for Health Protection and Promotion (Public Health Ontario). SARS-CoV-2 (COVID-19 virus) variant of concern (VoC) surveillance [Internet]. Toronto, ON: Queen's Printer for Ontario; 2021 [modified 2021 Mar 26; cited 2021 Apr 21]. Available from: https://www.publichealthontario.ca/en/laboratory-services/test-information-index/covid-19-voc

Genomic Characteristics of Key VOCs: B.1.1.7

gene	nucleotide	amino acid
ORF1ab	C3267T	T1001I
	C5388A	A1708D
	T6954C	I2230T
	11288-11296 deletion	SGF 3675-3677 deletion
spike	21765-21770 deletion	HV 69-70 deletion
	21991-21993 deletion	Y144 deletion
	A23063T	N501Y
	C23271A	A570D
	C23604A	P681H

Investigation of novel SARS-COV-2 variant

Variant of Concern 202012/01

Orf8	C27972T	Q27stop
	G28048T	R52I
	A28111G	Y73C
N	28280 GAT->CTA	D3L
	C28977T	S235F

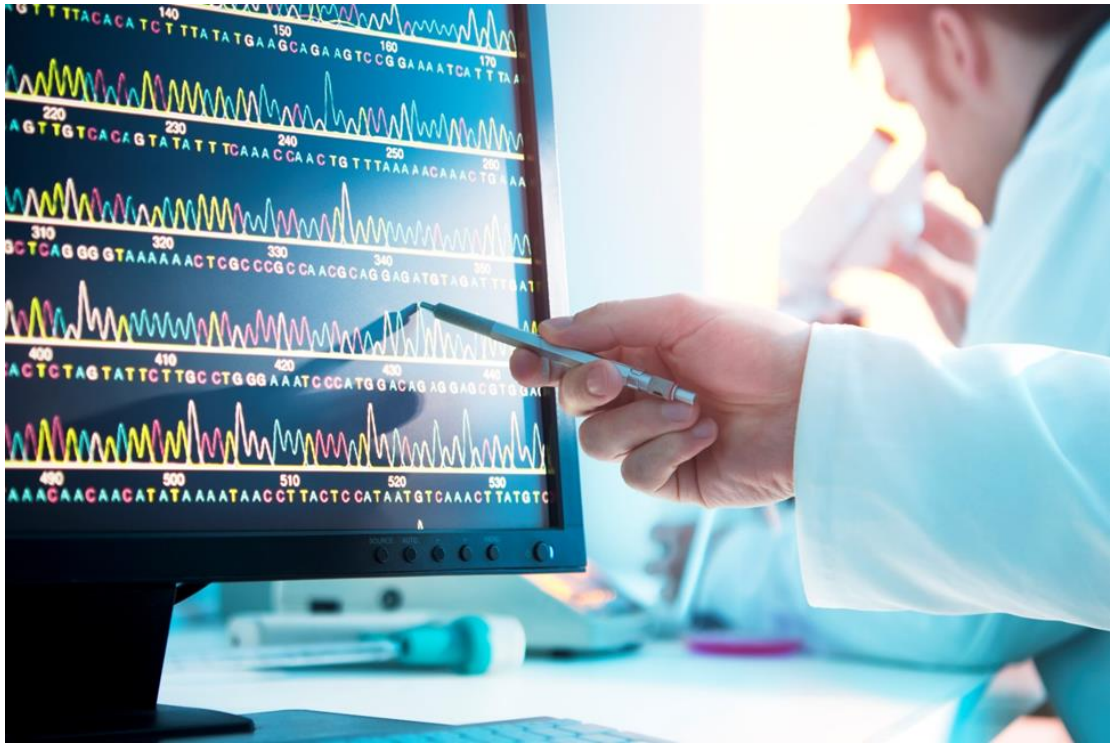
Table 1. Lineage-defining protein altering mutations defining the new variant.

The new variant is defined by 23 mutations: 13-non synonymous mutations, 4 deletions and 6 synonymous mutations. The non-synonymous mutations include a series of spike protein mutations (Table 1). Other notable mutations include a stop codon in ORF8. There are 6 synonymous mutations with 5 in ORF1ab (C913T, C5986T, C14676T, C15279T, C16176T), and one in the M gene (T26801C). This is an unusually large number of mutations in a single cluster.

Source: Public Health England. Investigation of novel SARS-CoV-2 variant: variant of concern 202012/01 [Internet]. London: Crown Copyright; 2021 [cited 2021 Apr 15]. Available from: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/959438/Technical_Briefing_VOC_SH_NJL2_SH2.pdf. Used with permission available from: https://www.nationalarchives.gov.uk/doc/open-government-licence/version/3/

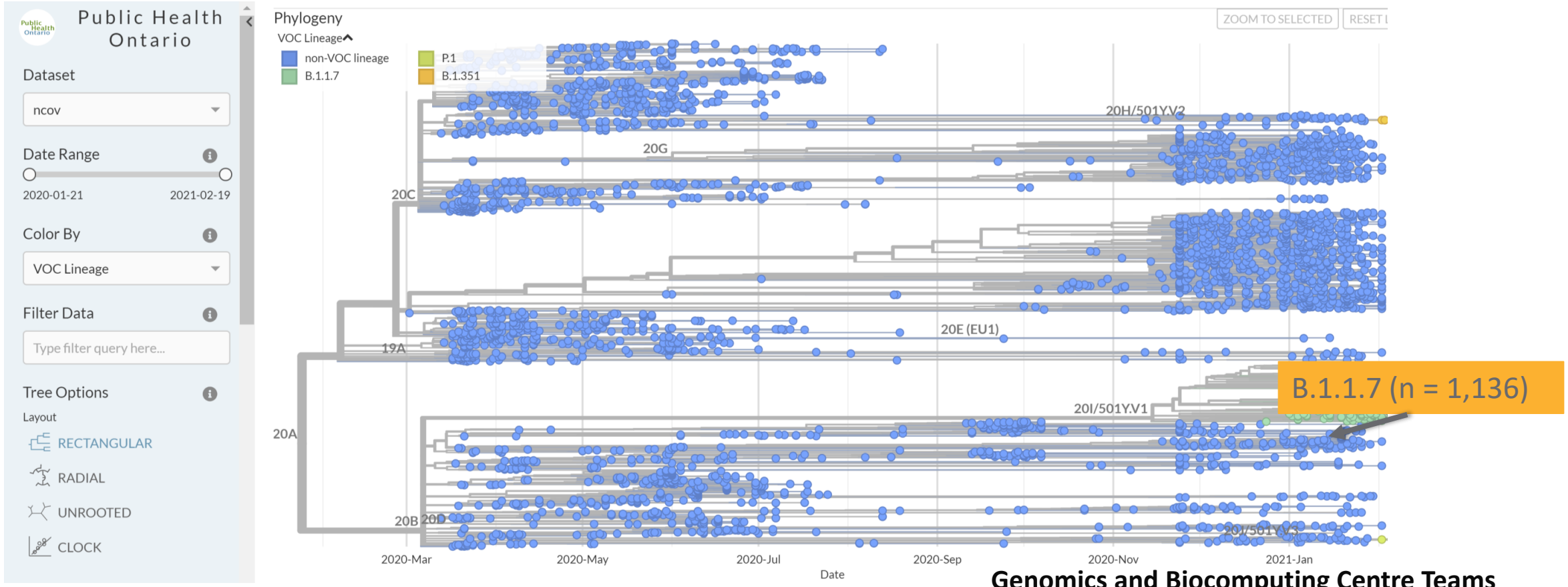
Other Uses of Whole Genome Sequencing

- Assessment of reinfection
- Post-vaccination infection (>14 days after completing vaccine series)
- Outbreak analysis
- Infections associated with travel
- Surveillance for novel mutations



PHO is launching a Nextstrain WGS interface as of March 31, 2021

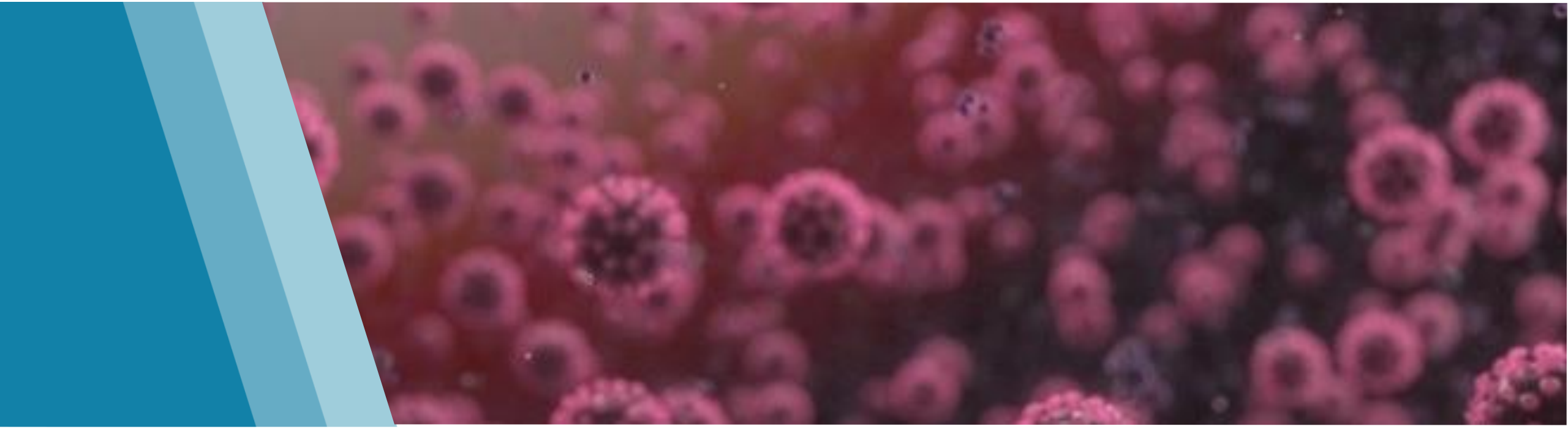
- Variants of Concern



Genomics and Biocomputing Centre Teams

Source: Ontario Agency for Health Protection and Promotion (Public Health Ontario). Phylogenetic analysis of SARS-CoV-2 in Ontario - Nextstrain [Internet]. Toronto, ON: Queen's Printer for Ontario; 2021 [modified 2021 Apr 01; cited 2021 Apr 23]. Available from: https://www.publichealthontario.ca/en/data-and-analysis/infectious-disease/covid-19-data-surveillance/nextstrain

Infection Prevention and Control (IPAC) for VOCs



VOCs and Transmission

- The predominant mode of transmission of COVID-19 is via respiratory droplets and aerosols during close (<2m), unprotected contact.
- No evidence that there is any difference in the modes of transmission of these VOCs, than what has been seen with non-variant SARS-CoV-2.

Source: Ontario Agency for Health Protection and Promotion (Public Health Ontario). COVID-19 routes of transmission – what we know so far [Internet]. Toronto, ON: Queen's Printer for Ontario; 2020 [cited 2021 Apr 15]. Available from: https://www.publichealthontario.ca/-/media/documents/ncov/covid-wwksf/2020/12/routes-transmission-covid-19.pdf?la=en

Variants of Concern

Provincial Infectious Diseases Advisory Committee (PIDAC) recommends:

- Continue with Droplet and Contact Precautions
- Continue with physical distancing (> 2 metres) where possible
- No recommended changes to personal protective equipment (PPE)
- IPAC measures work “as a team” and need to be carried out consistently

Source: Ontario Agency for Health Protection and Promotion (Public Health Ontario), Provincial Infectious Diseases Advisory Committee. Interim guidance for infection prevention and control of SARS-CoV-2 variants of concern for health care settings [Internet]. 1st revision. Toronto, ON: Queen's Printer for Ontario; 2021 [cited 2021 Apr 21]. Available from: https://www.publichealthontario.ca/-/media/documents/ncov/voc/02/pidac-interim-guidance-sars-cov-2-variants.pdf?la=en

Source: Ontario Agency for Health Protection and Promotion (Public Health Ontario). IPAC recommendations for use of personal protective equipment for care of individuals with suspect or confirmed COVID-19 [Internet]. Toronto, ON: Queen’s Printer for Ontario; 2021 [cited 2021 Apr 21]. Available from: https://www.publichealthontario.ca/-/media/documents/ncov/updated-ipac-measures-covid-19.pdf?la=en

Variants of Concern and Response by other Jurisdictions

- Most jurisdictions (11 of 14) reviewed have not made changes to or updated guidance for the type of mask, recommended or required, in public masking policies since the emergence of VOCs.
- This includes England where the B.1.1.7 variant is the dominant circulating strain.

Source: Ontario Agency for Health Protection and Promotion (Public Health Ontario). Type of mask required or recommended for the public to control transmission of SARS-CoV-2 with consideration of variants of concern: rapid environmental scan [Internet]. Toronto, ON: Queen's Printer for Ontario; 2021 [cited 2021 Apr 21]. Available from: https://www.publichealthontario.ca/-/media/documents/ncov/voc/2021/03/covid-19-types-of-masks-public-variant-of-concern.pdf?la=en

Variants of Concern and Response by other Jurisdictions

Quebec:

- After restricted use of N95 respirators to specific aerosol generating medical procedures (AGMPs), Quebec has added the use of N95 respirators in “Hot Zones” effective February 9, 2021.
  - Hot Zones defined as a group of users (two or more) with laboratory-confirmed COVID-19 in a single care unit or facility. An entire unit may be designated a hot zone.

Source: Commission des normes, de l’équité, de la santé et de la sécurité du travail (CNESST). COVID-19 – La CNESST oblige le port du N95 ou d’une protection supérieure en zone chaude [Internet]. Montreal, QC: CNESST; 2021 [cited 2021 Apr 21]. Available from: https://www.cnesst.gouv.qc.ca/fr/salle-presse/communiques/covid-19-cnesst-oblige-port-n95-dune-protection

Source: Commission des normes, de l’équité, de la santé et de la sécurité du travail (CNESST). Workplace sanitary standards guide for the public and private eldercare sector. Montreal, QC: CNESST; 2021. Available from: https://www.cnesst.gouv.qc.ca/sites/default/files/documents/dc100-2167a-3_guide-personnesagees.pdf

Variants of Concern and Response by other Jurisdictions

Quebec (continued):

- No new evidence was included in the review by Quebec National Institute of Public Health and the Quebec Nosocomial Infections Committee.
- The evidence to inform this decision is aligned with Public Health Ontario and Public Health Agency of Canada.[16]
  - Routes of transmission align – greatest risk during close and prolonged contact with increased risk in confined, crowded, and poorly ventilated spaces.
  - There is no direct evidence of long-range airborne transmission.
  - The document further summarizes that the available evidence suggest equivalence between respirators and surgical/medical masks.

Health care settings – N95 respirator use

PIDAC recommendations:

- No evidence that variants of concern are transmitted by a different mode.
- No changes are recommended at this time.
- Health care workers (HCWs) are reminded that Directive #5 provides HCWs with the prerogative to use a respirator when their personal risk assessment warrants.

Health care settings – What about double masking or “knot and tuck” ?

Background:

- Evaluation of double masking and “knot and tuck” was published in a recent MMWR report.[17]
  - Double masking is wearing a tight-fitting cloth mask over a medical mask.
  - Knot and tuck of medical masks is a process of tying ear loops close to the mask and tucking in the mask material to reduce gaps in its fit.[18]
- The report described an experimental simulation study using masked dummy headforms.
- One brand of cloth mask and one brand of medical mask were used for the experiment.

Health care settings – Double masking and “knot and tuck”

Experimental Simulation study results:

- **Source control:** Double masking or knot and tuck on the source blocked more particles generated during a simulated cough compared to using a three-layer cotton mask alone or a three-layer medical mask alone (85.4% and 77.0% versus 51.4% and 56.1%, respectively).
- **Exposure protection**: Double masking or knot and tuck modifications of a medical mask compared to unmodified medical mask use on both source and receiver, reduced wearer exposure to 96.4% and 95.9% from 84.3%, respectively.

Source: Brooks JT, Beezhold DH, Noti JD, Coyle JP, Derk RC, Blachere FM, et al. Maximizing fit for cloth and medical procedure masks to improve performance and reduce SARS-CoV-2 transmission and exposure, 2021. MMWR Mortal Morbid Wkly Rep. 2021;70(7):254-7. Available from: http://dx.doi.org/10.15585/mmwr.mm7007e1

Health Care Settings - PIDAC Recommendations

Universal Masking and Masking as Personal Protective Equipment

- Medical masks for staff who are working with patients/residents/clients.

- Double masking of medical masks is not recommended.

Source: Ontario Agency for Health Protection and Promotion (Public Health Ontario). Focus on: universal mask use in health care settings and retirement homes [Internet]. Toronto, ON: Queen's Printer for Ontario; 2021 [cited 2021 Apr 21]. Available from: https://www.publichealthontario.ca/-/media/documents/ncov/ipac/report-covid-19-universal-mask-use-health-care-settings.pdf?la=en

Variants of Concern – PIDAC Recommendations: Patient Masking

- Where health care settings expect patients to be masked, the health care setting should provide the patient with a medical mask (*unless there is a contraindication to masking or the patient is unable to mask*).

Examples of Patient Masking

- When visiting a client in their home.
- In all areas of an outpatient health care facility including the exam room.
- In all areas of an acute care hospital and within their rooms (if possible) when health care providers are in the room, or within 2 metres of the patient.
- In multi-bed rooms if patient is ambulatory and may come within 2 metres of another patient.
- Resident masking when outside the room should be supported when requested by the resident and they are interested in and able to mask.

Eye Protection

- Prescription eye glasses are not eye protection.
- Eye protection is a device that **covers the eyes from all sides** and is used by health care providers when:
  - It is anticipated that a care activity is likely to generate splashes or sprays of blood or body fluids or within two metres of a coughing/sneezing client/patient/resident.
  - When interacting with someone on Droplet and Contact precautions.
- Eye protection includes safety goggles, face shields, visors and some safety glasses.

Source: Ontario Agency for Health Protection and Promotion (Public Health Ontario). Focus on: face shields for source control of COVID-19 [Internet]. Toronto, ON: Queen's Printer for Ontario; 2020 [cited 2021 Apr 21]. Available from: https://www.publichealthontario.ca/-/media/documents/ncov/main/2020/07/covid-19-face-shields-source-control.pdf?la=en

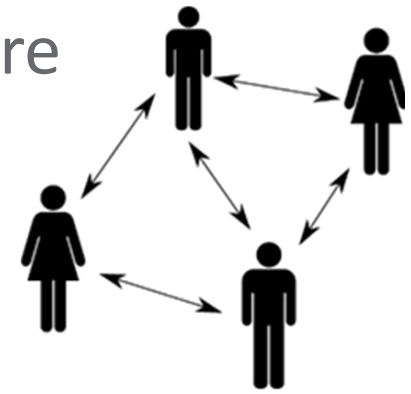
Where should I focus my attention?

Be vigilant with each fundamental IPAC measure as they all make a difference.

- Screening questions – becoming mundane (stay “in the moment”).
- Are my staff trained on donning and doffing of PPE?[19] Have staff been observed and feedback given? Including agency staff?
- How are masks and eye protection managed during coffee and meal breaks?[20] Are staff “over-extending” their use?
- Use of “safety coach” and morning huddles; share positive outcomes.[21]

Where Should I Focus My Attention?

- Environmental Cleaning and cleaning of high touch surfaces – no change.
- Although less common, transmission through fomites can still occur.
- Close, confined spaces…review of “re-purposed” rooms that are small and poorly ventilated to avoid accumulation of aerosols.
- All health care facilities should review their HVAC systems to ensure compliance with CSA Z317.2:19 or regulations related to facility type.
- Ensure sufficient break space and policies/procedures to ensure appropriate physical distancing and masking in these areas.
- Maintain >2m physical distancing – “~~Just a quick chat~~”



Cohorting and Patient Placement

- Patients with COVID-19 due to B.1.1.7 can be cohorted with other COVID-19 positive patients (as long as there are no additional contraindications to cohorting).
- In the absence of information, patients with a known VOC other than B.1.1.7 should be in a private room whenever possible.
- The indications for the use of an airborne infection isolation room are the same for patients with VOC and non-variant SARS-CoV-2.
- Discontinuation of precautions – no change in approach with VOC.

In summary – IPAC Practices

- No evidence that there is any difference in the modes of transmission of these VOC, than what has been seen with non-variant SARS-CoV-2.
- IPAC practices remain much the same for VOC.
- No changes in transmission-based precautions.
- With higher transmissibility, remain vigilant with all IPAC practices.

Public Health Ontario Resources on VOCs

- Variants of Concern (VOCs) - mainpage[22]
  - Data and Surveillance (daily, weekly and enhanced reports)
  - Knowledge Products (What We Know So Far, Synopses, Environmental Scans, Evidence Briefs)
  - Laboratory Information
  - Guidance for Health Care Settings

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Acknowledgements

- Public Health Ontario COVID-19 Team
- Public Health Units
- Ministry of Health
- PIDAC-IPC

For More Information About This Presentation, Contact:

epir@oahpp.ca

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