

Episode 52 – Omicron Variant of SARS-CoV-2 January 14, 2022

Variants[1]

- Variants are viruses that have mutated; these random mutations or changes arise as a virus evolves over time.
- Variants are common with coronaviruses.
- Most mutations have minimal to no impact on the virus' properties.
- Since January 2020, the World Health Organization (WHO), along with a global network of experts, have monitored and assessed the evolution of SARS-CoV-2.[2]
- WHO classifications for SARS-CoV-2 variants:
    - Variants under monitoring (VUM)
    - Variants of interest (VOI)
    - Variants of concern (VOC)
    - Formerly monitored variants [1] [2]

Variants under monitoring (VUM)

- A variant under monitoring (VUM) is a variant with genetic changes that may affect its characteristics and pose a future risk. Since evidence of its impact is unclear, the variant is monitored and reassessed as new evidence emerges.
- VUMs are not assigned a WHO label because they may be rapidly added or removed from this category as evidence evolves.
- Former VOIs and VOCs may be monitored under this category and maintain their assigned WHO label for a period of time.
- Current VUMs:
    - B.1.1.318, first documented in multiple countries in January 2021
    - C.1.2, first documented in South Africa in May 2021
    - B.1.640, first documented in multiple countries in September 2021 [1]

Variants of interest (VOI)

- A variant of interest (VOI) is a variant with genetic mutations that are expected or known to affect virus characteristics (e.g., transmissibility, disease severity, immune escape, diagnostic or therapeutic escape); and
- A VOI causes increased community transmission or multiple COVID-19 clusters/cases, in multiple countries, or other epidemiological impacts suggesting a developing global public health risk.
- Current VOIs:

[1] Refer to Episodes 34 & 39 for additional information on variants.
[2] Refer to Episode 28 for additional information on SARS-CoV-2.

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- Lambda, first documented in Peru in December 2020
- Mu, first documented in Colombia in January 2021 [1]

Variants of concern (VOC)
A variant of concern (VOC) is a variant that meets the VOI definition and is also associated with 1 or more of the following criteria at levels of global public health significance:

- Increased transmissibility or detrimental change in epidemiology;
- Increased virulence or change in clinical disease presentation;
- Decreased effectiveness of public health measures, diagnostic testing, vaccines,[3] or therapeutics. [1]

Current VOCs [1]

WHO label	Pango lineage	First documented	Date of designation
Alpha	B.1.1.7	United Kingdom September 2020	December 18, 2020
Beta	B.1.351	South Africa May 2020	December 18, 2020
Gamma	P.1	Brazil November 2020	January 11, 2021
Delta	B.1.617.2	India October 2020	VOI: April 4, 2021 VOC: May 11, 2021
Omicron	B.1.1.529	Multiple countries November 2021	VUM: November 24, 2021 VOC: November 26, 2021

Formerly monitored variants
Formerly monitored variants are previous VUMs, VOIs, or VOCs that have been reclassified based on the following criteria. The variant:

- Is no longer circulating at levels of global public health significance,
- Has been circulating for a long period of time without affecting the overall epidemiological situation, or
- Does not have any concerning properties.
- Currently, there are 17 variants in this category. [1]

Classification of Omicron (B.1.1.529) as a VOC

- Detection of B.1.1.529 variant in South Africa coincided with a steep increase in COVID-19 cases in that region.
- First known confirmed B.1.1.529 infection in South Africa was on November 9, 2021.
- B.1.1.529 variant was reported by South Africa to WHO on November 24, 2021.
- WHO designated B.1.1.529 a VOC on November 26, 2021 and named the variant Omicron (pronounced OH-mik-ron or AH-mik-ron). [3]
- Note: WHO has followed the Greek alphabet to name certain SARS-CoV-2 variants since May 2021 for simplicity and to reduce stigma by preventing referral of variants by their location where they were first detected. Since 2015, WHO has followed best

[3] Refer to Episodes 15, 28, 39, & 40 for additional information on COVID-19 vaccines.

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practices for naming new human diseases "to minimize unnecessary negative impact of disease names on trade, travel, tourism or animal welfare, and avoid causing offence to any cultural, social, national, regional, professional or ethnic groups." [1] [4]

Genomic features of Omicron

- Omicron has over 50 mutations, including 26-32 mutations in its spike protein (the protein that recognizes host cells and is the main target of the body's immune responses). [5] [6] [7]
- Some of the mutations immediately raised concerns of increased transmissibility and immune evasion. For example, many of the mutations have been found in variants such as Delta and Alpha, and are associated with increased infectivity and the ability to evade antibodies (i.e., evade humoral immunity or antibody-mediated immunity[4]). [6] [7]

Prevalence of Omicron

- As of December 22, 2021, Omicron had been identified in at least 110 countries across all 6 WHO Regions (i.e., Africa, Americas, South-East Asia, Europe, Eastern Mediterranean, Western Pacific). [6] [8]
- As of December 19, 2021, Omicron accounted for 72.1% of COVID-19 cases identified in Canada through whole genome sequencing (Delta 28.0%). [9]
- As of December 16, 2021, 11 provinces and territories reported Omicron cases. Many cases were not linked to travel, indicating established community transmission. [5]

Weekly variant breakdown in Canada [9]

VOC	Nov 21, 2021 (n=5,881)	Nov 28, 2021 (n=5,167)	Dec 5, 2021 (n=2,943)	Dec 12, 2021 (n=2,203)	Dec 19, 2021 (n=1,046)
Delta	99.7%	98.4%	84.8%	45.4%	28.0%
Omicron	0.3%	1.6%	145.1%	54.4%	72.1%
Other variants	-	0.0%	0.1%	0.3%	-

Prevalence in Ontario

- First Omicron case was identified in a traveller on November 22, 2021 via province-wide whole genome sequencing. [10]
- Percentage of Omicron cases identified via representative surveillance increased from 2.3% (Nov 28, 2021 to Dec 4, 2021) to 24.6% (Dec 5, 2021 to December 11, 2021). [11]
- Public Health Ontario (PHO) used screening data to estimate the prevalence of Omicron and its growth rate relative to Delta. The modelled proportion of samples screening positive for Omicron increased from <1% in November to 90% for samples collected on December 23, 2021. [10]

[4] Refer to Episode 44 & 45 for more information on humoral immunity and the immune system.

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Transmissibility
A study by Espenhain et al. (2021) emphasizes Omicron's transmissibility. On November 28, 2021, Denmark identified its first 2 Omicron cases, both in travellers returning from South Africa. Eleven days later, the number increased to 785 Omicron cases, and only 56 cases (8.7%) reported a history of travel. Contact tracing linked at least 83 cases to 5 large events in Denmark (> 100 participants), and cases were expected to increase with further contact tracing. More than 1 in 5 cases (28%) were not linked to a previous case, and given border restrictions and other measures, suggests widespread community transmission in Denmark shortly after the first cases were identified. [12]

On December 23, 2021, WHO reported Omicron to be spreading significantly faster than the Delta variant in countries with documented community transmission, with a doubling time between 2 to 3 days. [6]

PHO estimated each Omicron case infected 3.5 times more individuals than Delta from November 28 to December 23, 2021. The projected prevalence among individuals with COVID-19 on December 31, 2021 was >95%. Data from November 1,2021 to December 23, 2021 confirmed Omicron was highly transmissible and was already the dominant variant circulating in Ontario. [10]

In the United States, the first case of Omicron was identified on December 1, 2021. The individual was a traveller who returned from South Africa on November 22, 2021. By December 11, 2021, Omicron accounted for 8.0% of SARS-CoV-2 infections, 77.0% by December 25, 2021, and 95.4% by January 1, 2022. [13] [14] [15]

Recent data and evidence estimate Omicron is 4 to 8 times more infectious than Delta, and 2 doses of a COVID-19 vaccine provides 70% protection against hospitalization with Omicron compared with 90% against Delta. [16]

Ontario COVID-19 cases [17]

Cases	Dec 11, 2021	Dec 18, 2021	Dec 25, 2021	Jan 1, 2022	Jan 8, 2022
Daily new cases	1,607	3,301	10,412	18,445	13,362
7-day average new cases	1,194	2,156	5,939	12,496	13,118
Cumulative	630,671	645,766	687,336	774,806	866,632

Disease severity
Early data from South Africa suggested Omicron may be less severe than prior strains. However, South Africa's low average population age, extent of previous SARS-CoV-2 infections, and low vaccination rates affect generalizing this finding to other countries. [18]

A matched cohort study by PHO (2021) of over 11,000 Omicron cases estimated Omicron severity in Ontario from November 22 to December 25, 2021. The study found the risk of hospitalization was 65% lower for Omicron cases compared to Delta cases

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and the risk of ICU admission or death was 83% lower. However, even though evolving data demonstrate Omicron is less severe, its high transmissibility has caused a larger number of hospital admissions relative to ICU admissions. [18]

UK Health Security Agency (2021) reported the risk for adults presenting to emergency care or hospital admission with Omicron was approximately half of that for Delta. Further, the risk of being admitted to hospital with Omicron was approximately one third of that for Delta. Also, the risk of hospitalization was lower for Omicron cases after 2 and 3 doses of vaccine, with an 81% reduction in the risk of hospitalization after 3 doses compared to unvaccinated Omicron cases. The data cut off for the analyses was December 29, 2021.

The report indicated 3 vaccine doses were associated with an estimated 68% reduction in the risk of being hospitalized with Omicron compared with unvaccinated individuals.

One dose of any COVID-19 vaccine (Pfizer-BioNTech, Moderna, AstraZeneca[5]) was associated with a 35% reduced risk of hospitalization among symptomatic cases with the Omicron variant, 2 doses with a 67% reduction up to 24 weeks after the second dose, and a 51% reduced risk 25 or more weeks after the second dose when compared to unvaccinated individuals.

When the reduced risk of hospitalization was combined with vaccine effectiveness against symptomatic disease, vaccine effectiveness against hospitalization was estimated as:

- 88% after 2+ weeks after a third dose
- 72% after 2 to 24 weeks after 2 doses
- 52% after 25+ weeks after 2 doses

Preliminary analysis also suggested a lower risk of hospitalization with Omicron for school-age children (5-17 years),[6] compared with Delta.

However, any lower risks noted in the report do not imply reduced hospital burden given the higher growth rate and immune evasion observed with Omicron. [19]

Presenting symptoms

COVID-19 symptoms from the current Omicron-dominant wave were compared with symptoms from the Delta-dominant wave in London, England using data from the Zoe symptom tracker app. There was no clear difference in symptom profile of the top 5 symptoms for both VOCs. The top 5 symptoms were runny nose, headache, fatigue (mild or severe), sneezing, and sore throat. Only 50% of cases experienced the classic COVID-19 symptoms of fever, cough, and anosmia or ageusia. [20]

Brandal et al. (2021) analyzed an Omicron outbreak that occurred after a holiday party in Norway in November 2021. The incubation period for symptomatic individuals ranged

[5] Pfizer-BioNTech Comirnaty® COVID-19 vaccine, Moderna Spikevax® COVID-19 vaccine, AstraZeneca Vaxzevria® COVID-19 vaccine.

[6] Refer to Episodes 33 & 34 for additional information on COVID-19 and the pediatric population.

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from 0 to 8 days. Only 1 individual was asymptomatic, and 74 (91%) reported at least 3 symptoms. Among the 81 cases, the most common symptoms were cough (83%), runny/stuffy nose (78%), fatigue/lethargy (74%), sore throat (72%), headache (68%), and fever (54%). Severity of symptoms were graded by participants on a scale from 1 (no symptoms) to 5 (significant symptoms). Most (42%) indicated symptom severity as level 3, whereas 11% reported level 4. None of the individuals required hospitalization as of December 13, 2021. [21]

A study by the CDC COVID-19 Response Team (2021) from December 1-8, 2021 reported on 43 people infected with the Omicron variant in the United States. The most commonly reported symptoms were cough, fatigue, and congestion or a runny nose. Prior to the onset of symptoms, 34 individuals (79%) had completed a vaccine series, including 9 (21%) who had received a booster >14 days earlier. [22]

Vaccine effectiveness

A report by the Imperial College COVID-19 response team (2021) estimated immune escape characteristics by analyzing data from PRC-confirmed cases in England with no history of recent international travel. Researchers found a significant increased risk of Omicron compared to Delta for individuals ≥2 weeks post-second dose of AstraZeneca or Pfizer-BioNTech, and ≥2 weeks post-third dose AstraZeneca or Pfizer-BioNTech. Depending on the Delta vaccine effectiveness estimates used, researchers estimated vaccine effectiveness against Omicron to be between 0% and 20% after 2 doses, and between 55% and 80% after 3 doses. [23]

The UK Health Security Agency (2021) reported vaccine effectiveness against symptomatic disease was lower against Omicron than for Delta, with waning by 10 weeks after dose 3.

No protection against Omicron was seen in those who had received the AstraZeneca vaccine from 20 weeks after their second dose. Among those who had received 2 doses of Pfizer-BioNTech or Moderna vaccines, vaccine effectiveness dropped from 65-70% to 10% by 20 weeks after the second dose. Two to 4 weeks after a third dose, vaccine effectiveness ranged from 65-75%, dropping to 55-70% at 5 to 9 weeks, and 40-50% from 10+ weeks after a third dose. [19]

Garcia-Beltran et al. (2021) investigated vaccine-induced neutralizing antibodies against Omicron. Researchers constructed a harmless “pseudovirus” version of Omicron to evaluate the effectiveness of Pfizer-BioNTech, Moderna, and Johnson & Johnson vaccines. Using blood samples from 239 fully vaccinated individuals, 70 of whom had received a third dose of either Pfizer-BioNTech or Moderna vaccine, researchers measured how effectively each vaccine produced antibodies against the Omicron pseudovirus, as well as the Delta and wild-type viruses.

Two doses of an mRNA-based vaccine or a single dose of Johnson & Johnson vaccine elicited poor neutralization of Omicron. However, individuals who received 3 doses of an mRNA vaccine had very significant neutralization against Omicron, only 4-6-fold lower than wild-type (the strain with the original spike sequence), suggesting enhanced cross-

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reactivity of neutralizing antibody responses. Additionally, the Omicron pseudovirus infected 4 times more efficiently than wild-type and 2 times more efficiently than Delta. Overall, the study underscored the importance of a third dose of a mRNA vaccine to increase neutralizing antibody responses against extremely divergent SARS-CoV-2 variants. [24]

Research by Schmidt et al. (2021) demonstrated Omicron was associated with reduced neutralizing antibody responses following 2 doses of vaccine or previous history of SARS-CoV-2 infection. However, vaccinating individuals who had recovered from COVID-19 or administering a third dose of an mRNA vaccine (Pfizer-BioNTech or Moderna) to vaccinated individuals at least 6 months after the second dose of an mRNA vaccine substantially increased neutralizing activity against Omicron. [25]

Nemet et al. (2021) analyzed neutralization efficiency of the Pfizer-BioNTech vaccine against wild-type SARS-CoV-2 and the Beta, Delta, and Omicron variants of concern. Researchers found low neutralization efficiency with 2 Pfizer-BioNTech vaccine doses against the wild-type virus and the Delta variant, assessed more than 5 months after receiving the second dose, and no neutralization efficiency against the Omicron variant. A third dose of Pfizer-BioNTech vaccine efficiently neutralized infection with Omicron. However, even with 3 vaccine doses, neutralization against Omicron was lower (by 4 times) than against Delta. Durability of the third dose against COVID-19 still has to be determined. [26]

On December 8, 2021, Pfizer and BioNTech announced their preliminary laboratory studies demonstrate 3 doses of Pfizer-BioNTech vaccine neutralized Omicron, while 2 doses showed significantly reduced neutralization titers. Their data indicated a third dose increased the neutralizing antibody titers by 25-fold compared to 2 doses against the Omicron variant. Titers after the booster dose were comparable to titers observed after 2 doses against the wild-type virus, which are associated with high levels of protection. Further, since 80% of epitopes in the spike protein recognized by CD8+ T cells were not affected by mutations in the Omicron variant, 2 doses may still provide protection against severe disease. The companies continue work on an Omicron-specific vaccine and expect to have it available by March 2022, if required, to increase the level and duration of protection. [27]

On December 20, 2021, Moderna announced preliminary data from their booster trial and reported the authorized booster dose (50 mcg) of their mRNA COVID-19 vaccine increased neutralizing antibody levels against Omicron approximately 37-fold compared to levels in 2-dose recipients, and a 100 mcg dose increased antibody levels 83-fold. Moderna is also working on an Omicron-specific booster. [28]

Carreño et al. (2021) investigated the binding and neutralizing efficacy of antibodies induced by natural infection, vaccination, or both against Omicron and Beta. The *in vitro* study included serum samples collected from COVID-19 recovered individuals (convalescent) with or without vaccination, and double or triple vaccinated (Pfizer-BioNTech and Moderna) individuals.

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All serum samples showed a more than 14-fold reduction in neutralizing titers against Omicron, with titer levels below detection in 16% of samples. In contrast, only a 4-fold reduction in neutralizing titers against Beta was observed.

Over 70% of convalescent samples showed undetectable titers against Omicron. There were approximately 23-fold and 42-fold reduction in titers against Omicron for Pfizer-BioNTech and Moderna double vaccinated samples, respectively. However, the reduction was comparatively lower for triple vaccinated samples, with Pfizer-BioNTech and Moderna vaccines showing a 7-fold and 16-fold reduction, respectively.

In convalescent samples with Pfizer double vaccination, Moderna double vaccination, or Pfizer triple vaccination, the reduction in neutralizing titers against Omicron was 14-fold, 11-fold, and 13-fold, respectively. Overall, strong neutralizing titers was observed in these samples.

The findings underline the importance of a third vaccine dose to induce robust neutralizing titers against Omicron. Furthermore, the study reveals immunity induced by natural SARS-CoV-2 infection or 2-dose COVID-19 vaccination was insufficient to protect against Omicron. The highest benefit of vaccination was observed among individuals with prior infection. Overall, the findings underscore the need for developing variant-specific vaccines or immunizing individuals with a third vaccine dose. [29]

Planas et al. (2021) analyzed the sensitivity of Omicron and Delta to antibodies in sera of individuals previously vaccinated with Pfizer-BioNTech or AstraZeneca or infected with SARS-CoV-2. Five months after complete vaccination, sera from vaccine recipients barely inhibited Omicron. Sera from COVID-19 recovered individuals collected 6- or 12-months post symptoms displayed low or no neutralizing activity against Omicron. Receiving a third Pfizer-BioNTech dose as well as vaccination of previously infected individuals elicited an Omicron neutralizing response, with titers 6-to-23-fold lower against Omicron than against Delta. The study showed Omicron largely escaped most vaccine-elicited antibodies. However, Omicron was neutralized by antibodies generated by a third dose. [30]

Breakthrough infections[7]

A report by the Statens Serum Institut (2021) in Denmark compared vaccine status of individuals ≥12 years infected with Omicron compared to other variants, from November 22 to December 15, 2021. A total of 79% infected with Omicron had completed a 2-dose vaccine series, compared to 65% infected by other VOCs. Further, 10% of Omicron cases had received 3 doses, and 8% of other VOC cases had received 3 doses. [31]

As noted earlier, Brandal et al. (2021) analyzed an Omicron outbreak at a holiday party that had taken place in a private restaurant room in Norway. Most of the cases (n=79; 98%) and non-cases (n=27; 93%) were fully vaccinated, with a median time since receiving the last vaccine dose of 79 days for cases and 87 days for non-cases. Among cases who had 2 vaccine doses, 55% received Pfizer-BioNTech, whereas 23% received

[7] An infection of a fully vaccinated person is referred to as a vaccine breakthrough infection.

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Moderna. Among the 25 non-cases who had received 2 doses, 7 received Pfizer-BioNTech and 12 received Moderna. [21]

PHO reported Omicron was responsible for the highest percentage of vaccine breakthrough cases in Ontario (76.3%), as compared to breakthrough cases caused by Delta (46.3%) from November 21 to December 18, 2021. [11]

Reinfection

The Imperial College COVID-19 response team (2021), using all PCR-confirmed SARS-CoV-2 cases in England (excluding recent international travel) between November 23 and December 11, 2021, found Omicron was associated with a 5.4-fold higher risk of reinfection compared with Delta (after controlling for vaccine status, age, sex, ethnicity, asymptomatic status, region, and specimen date). The researchers estimated past infection may provide as low as 19% protection from infection with Omicron. [23]

Monoclonal antibody treatment

Planas et al. (2021) analyzed the sensitivity of Omicron and Delta to monoclonal antibodies[8]. The researchers tested 9 monoclonal antibodies clinically approved or in development. Six monoclonal antibodies lost all antiviral activity, and the remainder were 3 to 80 times less effective against Omicron than against Delta. The study showed Omicron escaped most therapeutic monoclonal antibodies. [30]

Cameroni et al. (2021) identified antibodies that neutralize Omicron and other SARS-CoV-2 variants. These antibodies target areas of the virus spike protein that remain essentially unchanged as the viruses mutate.

To assess the effect of SARS-CoV-2 mutations, the researchers created pseudoviruses with Omicron spike protein mutations and mutations found on the earliest variants identified in the pandemic. They found the Omicron variant spike protein was able to bind 2.4 times better than the spike protein found in the virus isolated at the beginning of the pandemic. Their Omicron version was also able to bind to mouse angiotensin converting enzyme-2 (ACE2) receptors efficiently, suggesting Omicron might be able to move back and forth between humans and other mammals.

The researchers also used antibodies from individuals previously infected with earlier variants, vaccinated, or previously infected and then vaccinated to investigate how well these antibodies protected against Omicron. They found antibodies from individuals previously infected with earlier strains and those who had received 2 doses of Sputnik V[9] or Sinopharm,[10] or 1 dose of Johnson & Johnson vaccine had little or no ability to neutralize Omicron. Antibodies from people who had received 2 doses of Moderna,

[8] Monoclonal antibodies are laboratory-made molecules administered intravenously to prevent severe forms of the disease in people at risk.
[9] Sputnik V is a non-replicating viral vector vaccine developed by the Gamaleya National Research Center of Epidemiology and Microbiology of the Ministry of Health of the Russian Federation.
[10] Sinopharm is an inactivated COVID-19 (Vero Cell) vaccine developed by Beijing Institute of Biological Products Co., Ltd. in China.

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Pfizer-BioNTech, or AstraZeneca retained some neutralizing ability, although reduced by 20- to 40-fold, much more than any other variants.

Antibodies from individuals previously infected and then vaccinated with 2 doses had approximately 5-fold reduced activity, demonstrating vaccination after infection was useful.

Antibodies from individuals who had received a third dose of Moderna or Pfizer-BioNTech showed only a 4-fold reduction in neutralizing activity, demonstrating a third dose is beneficial against Omicron.

All tested monoclonal antibody treatments, currently authorized for use, had no or had markedly reduced activity against Omicron *in vitro*, except sotrovimab, which had a 2- to 3-fold reduction of neutralizing activity.

However, when a larger panel of antibodies were generated against earlier variants was tested, 4 classes of antibodies retained their ability to neutralize Omicron. Antibodies of each of these classes target 1 of 4 specific areas of the spike protein present in not only SARS-CoV-2 variants but also a group of related coronaviruses, called sarbecoviruses. These conserved sites on the spike protein may persist because they play an essential function that the protein would lose if they mutated.

The finding that antibodies were able to neutralize by recognizing conserved areas in many different variants suggests developing vaccines and monoclonal antibody treatments that target these regions could be effective against a broad spectrum of emerging variants. [32]

On January 7, 2022, Health Canada issued a safety alert advising a high risk of treatment failure with the monoclonal antibody treatment of casirivimab and imdevimab based on analysis of neutralization activity against selected mutations of the Omicron variant. Casirivimab and imdevimab should now only be considered for individuals where Omicron has been ruled out and if it cannot be ruled out, other therapies should be considered.

The combination of casirivimab and imdevimab were authorized for use by Health Canada on June 9, 2021 for treatment of mild to moderate COVID-19, confirmed by SARS-CoV-2 testing, in adults and adolescents (≥12 years, weighing at least 40 kg) at high risk for progressing to hospitalization and/or death. [33] [34]

Reducing transmission

Layering key prevention measures to reduce SARS-CoV-2 transmission include:

- Getting vaccinated, including third dose when eligible – Research shows vaccines remain the best public health measure to protect individuals from COVID-19, slow transmission, and reduce the likelihood of new variants emerging. COVID-19 vaccines are very effective at preventing severe illness, hospitalizations, and death.

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- Wearing a well-fitted and well-constructed mask[11]
- Physical distancing
- Improving indoor ventilation
- Avoiding crowds and closed spaces
- Practicing hand hygiene and respiratory etiquette
- Staying home if ill or exposed to someone with COVID-19
- Cleaning high-touch surfaces regularly [35] [36] [37] [38] [39] [40]

Take home messages

- Current understanding of the Omicron variant will continue to evolve as more data become available.
- Omicron has caused a sharp increase in case numbers for several reasons:
    - Omicron transmits very efficiently between individuals because its mutations allow it to adhere to human cells more easily.
    - Omicron has immune escape characteristics which facilitates its ability to evade immunity from past COVID-19 infection or 2 vaccine doses.
    - Preliminary data suggests Omicron replicates faster in the upper respiratory tract than Delta and the original strain, and slower in the lower respiratory tract. [41]
- Other factors contributing to Omicron's spread include people spending more time indoors in the colder months and not following public health measures, such as distancing, wearing of a well-fitting mask, and avoiding crowds.
- Current evidence demonstrates 3 doses of COVID-19 vaccine provides good protection against severe COVID-19 caused by Omicron. It seems possible additional boosters may be needed; however, additional research is required.

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[11] Refer to Episode 25 for information on community use of face masks.

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COVID-19 mask use: Advice for community settings
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COVID-19: Support for people
https://www.ontario.ca/page/covid-19-support-people

Multilingual COVID-19 resources from Public Health Ontario on topics such as cleaning and disinfection, masks and face coverings, self-isolating, physical distancing and caring for others. Available in the following languages: Arabic, Bengali, Simplified Chinese, Traditional Chinese, Eastern Ojibwe, English, Farsi, French, German, Greek, Gujarati, Hindi, Italian, Japanese, Korean, Mohawk, Oji-Cree, Polish, Portuguese, Punjabi, Romanian, Russian, Somali, Spanish, Swampy Cree, Tagalog, Tamil, Ukrainian, Urdu, Vietnamese
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