

EVIDENCE BRIEF

SARS-CoV-2 Omicron Variant and Community Masking

12/15/2021

Key Messages

- Emerging evidence suggests that the SARS-CoV-2 Omicron (B.1.1.529) variant of concern (VOC) is highly transmissible, as it has higher growth rates and secondary household attack rates compared to the Delta variant, and associated with lower vaccine effectiveness. It is currently unclear if the observed increase in transmissibility could be related to an increase in infectiousness of aerosols.
- Prevention measures should be optimized with a layered approach to mitigate against conditions conducive to transmission such as the “3 C’s”: closed spaces, crowded places, and close contact. This approach includes wearing well-fitting and well-constructed masks.
- With the emergence of Omicron, multiple European jurisdictions (i.e., Denmark, England, France, Finland, Germany, Ireland and Norway) have maintained or strengthened masking recommendations and requirements in public settings where they may have previously relaxed or were considering relaxing masking policies. Some jurisdictions (i.e., France, Germany and Italy) have recommended masks with specific filtering levels (i.e., medical masks or respirators instead of cloth masks) in select settings such as public transit and schools.
- In the current Omicron risk context, it is recommended that mask fit and filtration are optimized. This can be achieved by wearing a non-fit tested respirator (N95s, KN95s) or well-fitted medical mask. A high quality 3-layer non-medical mask (i.e., cloth masks) can be a reasonable alternative if it promotes adherence. Respirators are designed to closely fit or seal to the face, and while fit-testing is not required for use in the community, N95s without fit-testing and KN95s cannot be assumed to filter all of the air inhaled (i.e., respiratory protection).
- Given the early evidence that Omicron variant is more highly transmissible than the Delta variant with potential increased contribution of aerosol transmission, and is associated with reduced vaccine effectiveness and increased risk of re-infection, selecting a mask that optimizes fit and filtration that can be worn correctly and comfortably by the general public in community settings may enhance the current public health measures.

Issue and Research Question

On November 26, 2021, based on possible increased risk of reinfection and increased ease of transmission, the World Health Organization (WHO) designated the SARS-CoV-2 B.1.1.529 lineage as a variant of concern (VOC) and named it Omicron. The first known and confirmed Omicron positive specimen globally was collected on November 8, 2021 in South Africa, although the precise timing and location of Omicron emergence remain unknown. At the time of publishing, the Omicron variant is the dominant variant in Ontario.¹

The evidence concerning the SARS-CoV-2 Omicron variant is rapidly changing; therefore, public health must re-evaluate the current measures used to combat transmission in order to protect the health of Ontarians and the healthcare system. Given the likely increased transmissibility, indications of vaccine/immune escape and uncertain severity of the Omicron variant, how can we improve the effectiveness of mask-wearing in community settings?

Methods

In considering feasibility, scope and timelines, we undertook a rapid review to update our summary of SARS-CoV-2 Omicron transmission and masking. A rapid review is a knowledge synthesis where certain steps of the systematic review process are omitted in order to be timely (e.g., duplicate screening).

We conducted literature searches on December 13, 2021, in MEDLINE and National Institutes of Health COVID-19 Portfolio (preprints). Search strategies are available upon request. English-language peer-reviewed and non-peer-reviewed records that described Omicron variant transmission and masking were included.

The jurisdictional scan of masking policies was informed by keyword searches in the Google search engine and government websites for literature related to Omicron and masking. A formal database search was not conducted due to time constraints; thus, some relevant articles may not be included. The following jurisdictions were searched: Denmark, England, Finland, France, Germany, Ireland, Israel, Italy and Norway.

Prior to publishing, Public Health Ontario (PHO) subject-matter experts review all knowledge products. As the scientific evidence is expanding rapidly, the information provided in this document is only current as of the date of respective literature searches. PHO will continue to assess the latest scientific evidence concerning public health measures targeting transmission of the Omicron variant.

Out-of-scope for this document was a review of infection prevention and control (IPAC) practices for healthcare and workplace settings. For guidance on IPAC practices in healthcare settings, please refer to PHO's *Interim IPAC recommendations for use of personal protective equipment for care of individuals with suspect or confirmed COVID-19*.² For guidance on IPAC practices for workplaces, please refer to the PHO *COVID-19 Workplace Resources* webpage.³

Main Findings

SARS-CoV-2 Transmission Dynamics

SARS-CoV-2 is transmitted at short range through exposure to respiratory particles that range in size from large droplets to smaller aerosols.^{4,5} Short-range transmission generally occurs within 2 metres (m) of an infectious individual (e.g., during a conversation with inadequate distancing, no barriers, no personal protective equipment). Short-range transmission may occur due to droplets or aerosols, but the relative contribution of either is specific to each case-contact interaction, which varies based on contextual factors including source/receptor and pathway characteristics.⁴

There is evidence supporting long-range aerosol transmission, particularly under favourable conditions (e.g., Chen et al. 2021, Grudlewska-Buda et al. 2021, Palmer et al. 2021).⁶⁻⁸ Epidemiological and modelling studies support that long-range transmission via aerosols occurs, especially when there are combinations of favourable source/receptor and pathway conditions such as indoor settings, inadequate ventilation, prolonged exposure time, high viral load, with certain activities (e.g., singing, exercising, yelling), and a lack of masking for source control.⁶⁻⁸ SARS-CoV-2 RNA has been detected at varying distances from patients and at a higher prevalence and concentration in aerosols compared to droplets; therefore, transmission is likely possible at both short distances with large respiratory droplets and aerosols (<2 m), and at longer distances with small aerosols (≥2 m) (e.g., Cherrie et al. 2021, Dinoi et al. 2021, Ribaric et al. 2021).⁹⁻¹¹ Transmission can also occur from contact of mucous membranes with hands contaminated with infectious virus, although this is not the predominant mode of transmission.¹²

Omicron Variant Epidemiology and Masking

Omicron carries the highest number of novel mutations documented (>50), compared to other VOCs.¹³ The significance of these mutations is not yet clear;^{8,9} however, some of the mutations have been associated with infectivity, immune escape, transmissibility and reduced susceptibility to monoclonal antibody treatment.¹⁰

On December 8, 2021, the Scientific Advisory Group for Emergencies (SAGE) in the United Kingdom (UK) reported that the Omicron variant has a growth advantage over the Delta variant, a doubling time of approximately 3 days (d) and higher household secondary attack rates.¹⁴ The report also notes that some superspreading events involving Omicron suggest aerosol transmission may be playing a bigger part of overall transmission compared to previous variants (low confidence). SAGE notes that Omicron circulation means that prevention of aerosol transmission (short- and long-range transmission) requires enhancement of existing preventative strategies, including ventilation and filtration, well-fitting masks and distancing or reduced density of people in indoor environments.

Recently, Gu et al. (2021) report on the detection of the Omicron variant in an asymptomatic, fully-vaccinated traveller (case A) in a quarantine hotel in Hong Kong, China, along with potential transmission to a fully vaccinated traveller in a room across the corridor (case B).¹⁵ Viral sequencing confirmed both cases were the Omicron VOC, and sequencing between cases differed by only one nucleotide. Authors suggest airborne transmission across the corridor is the most probable mode of transmission. Please see PHO Synopsis of this article for further details.¹⁶

Little epidemiological information is currently available for outbreaks involving the Omicron variant. In an epidemiological summary of Omicron cases reported in the United States (US) (December 1–8, 2021), 43 cases were reported of which 33% (14/43) reported international travel (Centers for Disease Control and Prevention COVID-19 Response Team 2021).¹⁷ While the report did not provide exact numbers, exposures for non-travel cases were related to household transmission or large public events. No information on personal protective behaviours (e.g., mask-wearing) was reported for those infected, except that 79.0% (34/43) of cases were vaccinated.¹⁷

The literature search did not return any published or preprint studies related to the Omicron variant and masking. While much remains unknown for Omicron, we have utilized knowledge of Delta, which can help inform policies surrounding Omicron masking and transmission prevention. Previously, PHO assessed potential mechanisms for the increased transmission of VOCs.¹⁸ Evidence has emerged that other VOCs, such as Delta, have higher aerosol and surface stability, meaning that Delta may be more easily transmitted via long-range aerosols and fomites, respectively.^{19,20} Recently, several case studies of superspreading events involving Delta occurred in various settings (i.e., hospitals, school) with high secondary attack rates despite use of appropriate personal protection and physical distancing.^{21–23} In a matched case-control study on household transmission (≥ 2 cases within 14 d) in England that compared Delta variant and Alpha variant cases (March to June 2021), Allen et al. (2021) included 5,976 index cases and 11,952 contacts.²⁴ The odds ratio of household transmission was 1.7 among Delta variant cases (95% confidence interval [CI]: 1.48–1.95), compared to Alpha variant cases.²⁴ In a preliminary study using updated data, the UK Health Security Agency (2021) reported an increased risk of household transmission from an Omicron index case compared to a Delta index case (adjusted odds ratio [aOR]: 3.2, 95% CI: 2.0–5.0).²⁵ In addition, there was an increased risk of a close contact becoming a secondary case (aOR: 2.1, 95% CI: 1.54–2.79). The household secondary attack rate of Omicron using routine contact tracing data was 21.6% (95% CI: 16.7–27.4), compared to Delta at 10.7% (95% CI: 10.5–10.8).²⁵

Masking Policies in other Jurisdictions

Although this scan focused on masking guidance in response to Omicron, some of the guidance reported may also be in response to the ongoing Delta resurgence in Europe, which coincides with the emergence of Omicron. Wherever possible, the language used in guidance documents was retained (e.g., “should” or “required” or “it is recommended”); however, if primary sources were not found, the scan retained the language used in the secondary, grey literature (i.e., media).

With the emergence of the Omicron variant, most jurisdictions included in this rapid scan (i.e., Denmark, England, France, Finland, Germany, Ireland, Norway) have maintained or strengthened recommendations or requirements for masks in public settings where they may have previously relaxed or were considering relaxing masking policies. No mask policy updates were found for Israel beyond those published in June of 2021.

There is heterogeneity in the jurisdictions scanned, in terms of masking policies and recommendations. In terms of types of masks, France, Germany, and Italy are examples of jurisdictions with masking policies that specify the requirement for masks with a certain level of filtering, with France and Germany introducing these recommendations or requirements in January 2021 when it became clear variants could lead to increased transmissibility.²⁶ Currently, France recommends masks with 90% filtration for use in public settings and in schools, and recommends cloth masks no longer be used.^{27,28} Germany was one of the first countries to mandate use of either single-use filtering face piece (FFP) respirators (e.g., N95s) or medical masks in January 2021.²⁶ In Italy, since the Delta resurgence and emergence of Omicron, FFP2 (the European equivalent of N95) are required for bus drivers to wear on public transit.²⁹

DENMARK

- Current guidance states face masks or shields (mask type not specified) are required on public transport; at restaurants, bars and cafes when guests are not sitting down; in grocery stores, shops and shopping centres; in any health sector setting (i.e., hospitals, clinics); at social services and nursing homes in common areas with public access; and personal businesses (e.g., massage, haircut, tattoo) may implement their own masking requirements.³⁰
- At time of writing, face masks are not required at the following settings which do require a COVID-19 Certificate to attend: museums, amusement parks, theatres, cinemas, concert venues, zoos and aquariums, stadiums or other sports venues, swimming pools and play and water parks with more than 100 visitors indoors or 1,000 visitors outdoors.³⁰
- Children under 12 years old are generally exempt from wearing face masks.³¹ Children in primary school will be sent home from December 15, 2021 to January 4, 2022, and boarding school students are to be sent home December 19, 2021 to January 7, 2022 with virtual education to be made available.³⁰ Guidelines when children physically attend school do not include information related to masks, but strongly recommend students in grade one onwards be tested on a weekly basis unless they are fully vaccinated or had a previous COVID-19 infection.^{30,32} Plans for the return to school in January, as of December 15, 2021, also do not include masking requirements for children in schools but emphasize vaccination, increased testing and cohorting students when possible.³³

ENGLAND

- Effective November 29, 2021, face coverings should be worn in communal areas in all education settings by staff, visitors and students in year seven and above, unless they are exempt.³⁴ Effective November 30, 2021, face coverings are legally required in shops and on public transport. This temporary measure will be reviewed after three weeks.³⁵ Effective December 10, 2021, face masks are a legal requirement in more public indoor areas, including theatres, cinemas, hairdressers, tattoo studios and nail bars, takeaways (curbside pick-up of food and drink) and other settings.³⁶ As of December 10, 2021, face masks are not required in pubs, restaurants or gyms, and they can be removed when it is "reasonably necessary"; for example, if in a choir or on stage.³⁷
- The UK's Department of Education updated their education and childcare settings contingency framework on December 15, 2021.³⁸ As a temporary measure, it is recommended staff, adult visitors and students age 11 and older should wear masks when moving around the school outside of classrooms and must wear masks when travelling on public transport. Masks in classrooms may be temporarily advised in settings managing outbreaks or enduring transmission settings. Children of primary school age and early years should not be advised to wear face coverings.³⁸

FINLAND

- The first weekend of October 2021, several COVID-19 public health measures were lifted, with some exceptions, including mask use on public transport and when indoors and distancing cannot be maintained, and mask use outdoors in crowded situations.³⁹ Effective November 26, 2021, the health authority recommended masks continue to be used especially in public indoor settings where many people are gathered close to each other.⁴⁰ The recommendation applies to both vaccinated and unvaccinated persons. In addition, individuals are encouraged to follow the masking guidance provided by their health care district and municipality.⁴⁰
- Masking rules generally apply to children aged 12 years and older.⁴⁰ National school-specific masking guidance was not identified, but in a City of Helsinki source dated September 8, 2021, students in grade six and upwards are asked to wear a face mask while in school.⁴¹

FRANCE

- France recommends masks with 90% filtration for use in public settings and recommends cloth masks no longer be used.²⁷ Effective November 26, 2021, masks became mandatory in all indoor spaces – even those that require a valid health pass (i.e., immunity certificate) for entry, as well as for large gatherings outdoors, such as Christmas markets.^{42,43}
- Effective November 15, 2021, wearing a mask was again mandatory in elementary schools.⁴⁴ The Ministry of National Education, Youth and Sports has established a health framework to guide COVID-19 precautions in schools and includes four levels.⁴⁵ As of December 9, Level 3 applies to all schools which mandates mask wearing for elementary, middle and high school students in confined spaces and outdoors.^{28,45} Guidance also notes in relation to student mask requirements, given the appearance of SARS-CoV-2 variants only surgical masks or consumer masks with filtration capacity greater than 90% can be worn.²⁸

GERMANY

- Germany was one of the first countries to mandate use of either single-use surgical masks or FFP2 respirators (i.e., N95), in January 2021.²⁶ Masks and FFP2 respirators are mandatory for the general public on public transport and when shopping.⁴⁶ In addition, masks and respirators must be worn during indoor large-scale sports, culture and similar events, as well as at outdoor events.⁴⁷
- In schools, masks are compulsory for all grades.⁴⁶

IRELAND

- Effective October 22, 2021, Ireland eased several restrictions; however, face masks remained mandatory in retail, banks, on all forms of public transport and for customer-facing workers in cafés, libraries, entertainment venues (e.g., cinemas), museums, personal services (e.g., salons), bars and restaurants.⁴⁸
- Mask guidance updated as of December 1, 2021 requires masks in the following settings: retail outlets, banks, credit unions and post offices, in taxis, in bus and rail stations, on public transport and for workers in customer facing roles in cafés, bars and restaurants.⁴⁹

- Guidance also recommends masks in the following settings: visiting homes of people over age 70 or who are medically vulnerable (visitors and residents); travelling in a vehicle with someone you do not live with; crowded workplaces; places of worship; busy or crowded outdoor spaces where there is significant congregation; in circumstances where 2 m distance can't be maintained.⁴⁹
- Medical grade masks are recommended for: vulnerable people in indoor or outdoor crowded spaces; people age over 70 in crowded spaces; people with confirmed COVID-19 diagnosis; people with symptoms of COVID-19; and close contacts of confirmed COVID-19 cases.⁴⁹
- Children in grade three and above should wear a face covering in primary school. This new measure has been introduced on a temporary basis and will be reviewed in mid-February 2022.⁵⁰

ISRAEL

- The most recent announcements from Israel's Ministry of Health are from the summer. On June 15, 2021, Israel dropped its mask mandate.⁵¹ Soon after, on June 26, 2021, masks were again required in all indoor settings, except for permanent places of residence, and are recommended during large outdoor gatherings.⁵²
- Children under the age of seven years are exempt from masking requirements.⁵²

ITALY

- As of December 13, 2021, all but three regions in Italy are in the White Zone (i.e., lowest risk level).⁵³ In the White Zone, masks must be worn in indoor public places such as bars, restaurants, museums and public transport. Masks are not mandatory outdoors.⁵⁴ In response to Omicron, Italian authorities are considering bringing back outdoor mask mandates; however, local authorities in several Italian cities have already announced their own outdoor mask mandates in response to Omicron.⁵⁵ On public transport, bus drivers must wear an FFP2 respirator (European equivalent of N95) or equivalent.²⁹
- In Italy, surgical masks are provided to staff and students in schools.⁵⁶

NORWAY

- As of December 9, 2021, the Norwegian Ministry of Health and Care Services published updated national rules and recommendations.⁵⁷ In restaurants, night clubs, retail settings, personal service settings, public buildings and on public transport, masks are required if a 1 m physical distance cannot be maintained. Masks are recommended in workplace settings and outdoor events when 1 m distance cannot be maintained.⁵⁷
- In Norway, there are no mask mandates for children in kindergarten and primary school (levels 1-7).⁵⁸ Masks (cloth at least) are recommended for students in junior high school or high school (in yellow or red action levels, when advised by the respective municipality, when 1-m physical distancing cannot be maintained). Children aged 12 years and under are not recommended to use face masks, and children under two years should not use face masks.⁵⁹ Mask use is advised for employees in certain situations.⁵⁸

Masking for Reducing SARS-CoV-2 Transmission

On November 1, 2021, PHO published *Community non-medical and medical mask use for reducing SARS-CoV-2 transmission*.⁶⁰ One of the key points from that evidence review was that experimental data support 3-layer/multilayer non-medical masks, medical masks and respirators (i.e., N95s) as providing better filtering efficiency (compared to single or double layer cloth masks), which may translate to a reduction in SARS-CoV-2 transmission. The evidence comparing non-medical masks and medical masks is largely limited to experimental studies evaluating filtering efficiency and is not based on clinical or real-world settings. Considerations for the type of mask used for source control and personal protection should include filtration efficiency, fit, breathability, comfort and adherence to optimize the protection of those around the mask wearer.⁶⁰

Masking has been an important component of a layered approach to mitigating SARS-CoV-2 transmission and is an important public health strategy.

- In a systematic review and meta-analyses of eight studies (2,627 people with COVID-19 and 389,228 participants), Talic et al. (2021) reported that COVID-19 incidence was reduced when mask-wearing (any mask type) policies were in place (relative risk [RR]: 0.5, 95% CI: 0.29–0.75), followed by physical distancing (RR: 0.8, 95% CI: 0.59–0.95).⁶¹ The authors noted that it was not possible to evaluate the impact of mask type, compliance and wear frequency due to a lack of data.
- In a modelling study, Bagheri et al. (2021) calculated risk of infection and exposure and reported that when an infectious person is speaking with another person for 1 hour and both are wearing a surgical mask, the upper bound risk is 30%. This upper bound conservative risk calculation is reduced to 0.4% if a FFP2 is worn.⁶² For an exposure period of 20 minute, fitted FFP2 reduce the risk of infection by a factor of 30 (compared to loosely worn FFP2s) and by a factor of 75 (compared with fitted surgical masks).⁶²
- Duncan et al. (2021) investigated aerosol particle (<5 µm diameter) penetration and total inward leakage through face masks (i.e., re-usable fabric two-layer masks, re-useable fabric multi-layer masks, disposable procedure/surgical masks, KN95 masks and fit-tested and seal-checked N95 FFR).⁶³ The percent overall penetration of particles was highest for 2-layer masks (≈56%), followed by multi-layer (≈28%), procedure (≈10%), N95 FFR (≈1.4%) and KN95 (≈0.7%). Modelling a viral concentration of 0.01% and particle size of 0.3 µm, the percent reduction in viral penetration, compared to a 2-layer mask, was 99.2% for N95 FFRs, 96% for disposable procedure/surgical masks, and 59% for multi-layer masks. The authors concluded that N95 FFRs were the only devices investigated that provided both high fabric protection factor (FPF) and total inward leakage protection factor (TILPF). Further, N95 FFRs are the best option to protect individuals from exposure to aerosols in high-risk settings.⁶³ In addition, mask fit with an effective face seal is more important to increasing TILPF than the mask material. Please see PHO's Synopsis for this article for further information.⁶⁴

Implications for Practice and Recommendations

Until we have a better understanding of Omicron transmission, disease severity, immune escape and vaccine effectiveness, we recommend a precautionary approach to preventing spread and to protect the healthcare system. This cautious approach underlines the importance of layered measures to prevent SARS-CoV-2 transmission, with the aim of reducing morbidity and mortality. Several resources exist for community guidance (e.g., non-health care workplaces, public and private spaces) on how to reduce the risk of SARS-CoV-2 transmission through a layered approach of multiple public health measures designed to mitigate transmission.⁶⁵⁻⁶⁷

The cornerstone of a layered approach to preventing SARS-CoV-2 is measures to mitigate exposure to settings with the “3 C’s”: closed spaces, crowded places, and close contact. The degree to which various mitigation layers are necessary or possible will depend on the setting and risk context, noting that not everyone can avoid the 3 C’s. Transmission can be mitigated through layers encompassing:⁶⁸ getting vaccinated including third doses when eligible; staying home if you have symptoms of COVID-19⁶⁹ or if you have been exposed to someone with SARS-CoV-2 infection and following current testing advice; limiting the number and duration of contacts with individuals outside your household; physical distancing and avoiding crowded, indoor spaces where possible; improving ventilation and/or filtration to the extent possible (including natural ventilation) and using outdoor environments; rapid antigen screen testing where appropriate and available; hand hygiene and respiratory etiquette; and wearing a well-fitted and well-constructed mask.

While there are limited real-world data to support a preference for wearing a 3- or multi-layer non-medical masks or medical masks or respirators, given Omicron’s concerning increased transmissibility, potential for vaccine/immune escape and uncertain severity, we recommend the following as a precautionary approach to the masking layer of prevention:

- Optimizing fit and filtration for masks worn in community settings, particularly for “3 C” settings that cannot be avoided, such as public transportation or crowded public indoor settings such as large retail or event venues.
- Optimizing fit and filtration can be achieved with the use of non-fit tested respirators and medical masks. A well-fitting, well-constructed three-layer cloth mask (i.e., two layers of tightly woven fabric and a third filter-type layer such as non-woven polypropylene)⁷⁰ can still be used, and may be preferable in situations where it leads to increased adherence (e.g. younger children).
- Single-layer, scarf-style masks and 2-layer masks are not recommended for optimizing the masking layer because they do not include a filter layer and are not made of effective materials.⁷⁰
- Other considerations in choosing a mask should incorporate the relative risk of the mask-wearer, such as medical mask/respirator use for those at higher risk of infection due to older age or immune compromise.
- While mask use in children and in school or childcare settings was out of scope for this review, considerations of comfort, tolerability, adherence, and fit are important when selecting an appropriate mask for use by children.

Generally, in terms of mask fit, the mask should completely cover the nose and mouth and be comfortable enough to wear for long periods to improve adherence. Individuals should aim to ensure as good a seal as possible for their mask or respirator. Medical masks and respirators have benefits of improved filtration and fit; however, the effectiveness of any mask or respirator is highly dependent on appropriate use by the wearer and in community settings respirator use should not be expected to provide total filtration of inhaled air. Respirator function (complete filtration of inhaled air) may not be achieved in the absence of fit-testing and seal-checking procedures. The additional benefits of KN95 and N95 respirators will be dependent on consistent appropriate use, the degree of fit and inward leakage.

Recommendations for masking in public settings are drawn from existing PHO guidance and messaging from the Public Health Agency of Canada, with recommendations applied to the current Omicron risk context in Ontario.^{13,60,70} Medical masks and respirators that fit well can provide better filtration than non-medical masks, if they are worn consistently and correctly. A well-fitting 3-layer cloth mask of effective materials is a reasonable alternative in populations where its use will lead to increased mask adherence. 1- or 2-layer non-medical masks are not recommended to protect others or the wearer. Equity considerations must be taken into account when making recommendations on medical masks and respirators to the public, and should consider settings where provision may be reasonable to support equitable access.

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