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Omicron in Ontario: Risk Analysis for Approaching Public Health Measures in Winter 2022

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Key Messages

- The limited evidence of a characteristic Omicron epidemic curve suggests some Omicron waves may peak around four weeks (e.g., South Africa); however, the post-peak trajectory of the curve is highly uncertain due to various drivers and risks, which will vary by jurisdiction. Recent reports of the BA.2 Omicron sub-lineage displacing the original BA.1 Omicron in some jurisdictions makes predicting the trajectory of Omicron waves yet more challenging.

- The true epidemiology of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infections in Ontario is unknown at this time due to changes in polymerase chain reaction (PCR) testing eligibility and lack of rapid antigen test (RAT)-based surveillance. It is therefore challenging to accurately identify the peak of Ontario's Omicron wave using traditional metrics. Modelling is also more challenging as new data sources and models must be developed. If relying on proxy measures of cases (e.g., wastewater), triangulation across indicators will provide greater confidence if they all indicate a decline.

- While data caveats exist, the timing of recently implemented public health measures in Ontario coincides with a stabilization of some indicators, suggesting measures have been effective towards flattening the curve. As measures are removed and contact rates increase, increased spread will be likely during winter 2022.

- With the majority of Ontarians likely to not have been infected with Omicron at this time, there may be several potential trajectories for Ontario, assuming an initial plateau in late January 2022. These include an Omicron resurgence upon removing public health measures; a plateau at a moderate to high level of transmission; and gradual decline over time. The risk level for these scenarios ranges from high to moderate risk to the health system, with growing evidence of severe illness requiring hospitalization for a proportion of the population infected with Omicron.

- Actions can be taken to mitigate the risk of a resurgence, protect the health and well-being of Ontarians, and mitigate inequities as public health measures are removed. These can include consideration for re-implementation of community-based public health measures in some higher risk settings to reduce contact rates, using a three to four week period of data before removing measures when indicators are improving, updating policies and programs as evidence and context changes, and continuing the use of layered public health measures as needed.

Scope

The purpose of this document is to provide public health planning considerations as Ontario has seen some stabilization of indicators for the current SARS-CoV-2 Variant of Concern (VOC) Omicron (B.1.1.529, first reported in South Africa) wave.[1] This document provides practical potential Ontario scenarios of what the coming weeks after a first Omicron epidemiological peak could look like, signals to monitor the epidemiological situation in Ontario, and potential public health actions including public health measures. Modelling of scenarios is out of scope; however, the considerations outlined below may be useful alongside future modelling projections for the province.[2]

This risk analysis does not examine potential new variants becoming dominant in Ontario; however, an important planning assumption for 2022 for future risk assessments and analyses is that new variants will continue to emerge as high levels of transmission exist in many parts of the world.[3]

This document will cover considerations in Ontario up to end of March 2022. Winter 2022 risk analysis assumptions include:

- While there is ongoing risk of new variants entering Canada, the analysis assumes Omicron will remain the dominant strain in Ontario.
- New treatments sufficient to change the public health strategy will not be widely available in the immediate term (i.e. oral antivirals).
- Current isolation and self-monitoring requirements and guidance for Coronavirus Disease 2019 (COVID-19) cases and contacts remain in place.[4]

Methods

This document was created based on previous Public Health Ontario (PHO) documents, ongoing scanning of the Omicron literature, and documents referred by subject matter experts. The information in this document is up to date as of January 25, 2022.

Omicron Characteristics

Modelling studies estimate that Omicron is more transmissible than Delta.[5] Preliminary evidence suggests Omicron causes less severe disease than Delta; however, there is insufficient data on hospitalization outcomes, long-term sequelae, and mortality.[6] Evidence strongly suggests that Omicron can evade vaccine-acquired and infection-acquired immunity, but three doses of an mRNA COVID-19 vaccine provides greater protection against severe outcomes of infection compared to two doses or previous infection.[6] There is also evidence of stronger antibody responses in vaccinated, previously infected individuals compared to vaccinated individuals without previous infection, or individuals with previous infection and no vaccination.[7] The duration of protection from a third dose or recent infection remains unclear.[8,9]

Due to increased transmissibility of Omicron and a remaining proportion of the population who are un/under-vaccinated or ineligible for vaccination, as well as waning immunity, the absolute number of severe cases poses a significant threat to health system capacity in many jurisdictions. At this time, there is limited evidence to characterize Omicron epidemic curves,[10-12] and Ontario is experiencing an Omicron wave at the same time as many jurisdictions except South Africa, rendering it challenging to learn from other peer jurisdictions.

Predicting the trajectory of ongoing Omicron waves is further complicated by reports of increasing prevalence of the BA.2 Omicron sub-lineage and displacement of the original BA.1 strain in the United Kingdom (UK) and Denmark.[13,14] The Omicron lineage BA.2 does not contain the Spike deletion at position 69-70 and therefore is S-gene target positive (SGTP), making it indistinguishable from Delta if relying on SGTP as a proxy for Delta in the Omicron era.[15] In week 52, BA.2 accounted for 20% of COVID-19 cases in Denmark, increasing to approximately 45% in week 2.[14]

Ontario Epidemiology

In Ontario, during the week of December 19-25, 2021, 89.8% of samples tested at the PHO laboratory exhibited S-Gene Target Failure (SGTF), indicating that Omicron was the dominant circulating variant.[16] Due to changes in the eligibility criteria for PCR testing in Ontario effective December 31, 2021, reported confirmed case counts after this date are a greater underestimate of the true number of individuals with SARS-CoV-2 infection than in previous waves. In addition, although local examples of RAT tracking exist,[17] there is no provincial requirement or mechanism for the general population to report results of RATs, the use of which has varied across the pandemic. Routine epidemiological measures such as the reproduction number and percent positivity are therefore more challenging to interpret as they are less representative of the total susceptible population. As such, alternate approaches to monitor SARS-CoV-2 are also being used (e.g., hospitalization, wastewater). For more details on epidemiology and measures over the pandemic waves in Ontario see **Appendices A and B**.

Despite the current case counts being an underestimate, Ontario continues to report its highest case incidence and hospitalization rates. In Ontario, cases in the past two months make up a substantial proportion of cumulative cases in the pandemic to date.[18] While evidence in Ontario suggests lower disease severity in Omicron cases compared to the more severe Delta VOC, the absolute number of hospitalizations and impact on the healthcare system is significant due to Omicron's increased transmissibility, ability to evade vaccine and prior infection-induced immunity, and its severity for a proportion of the infected population, particularly for un/under-vaccinated or high-risk individuals.[19]

- The Ontario 7-day confirmed case average increased from 838 on December 1, 2021 to 12,036 on December 31, 2021, and was 9,596 on January 17, 2022. It is challenging to interpret recent trends due to the changes to testing eligibility. Prior to the Omicron wave, the highest COVID-19 pandemic 7-day case average in Ontario was 4,455 on April 19, 2021.

    - In Ontario, Omicron cases were initially more prevalent in younger age groups than older age groups; however, the rate of confirmed cases of COVID-19 per 100,000 was increasing in the 80+ age group during week 1 and 2 of 2022, along with long-term care (LTC) outbreaks.[1] This may reflect post-holiday effects from multi-generational gatherings, and the fact that individuals in this age group are eligible for testing relative to other ages. However, the data suggest older age groups will have an Omicron peak later (i.e. Omicron peaks may be age differential). Community-based public health measures remain important to protect vulnerable groups who are at highest risk of severe outcomes even after a population-level peak.

- For most of the summer and fall of 2021, the Ontario COVID-19 laboratory test positivity remained below 4%.[18] On December 31, 2021 (i.e., PCR test eligibility change),[20] the percent positivity was 34.3%.[18] On January 8, 2022, the percent positivity was 27.7%, and on January 20, 2022, it was 17.7%. It is challenging to interpret recent trends due to the changes to testing eligibility (restricted to only high-risk individuals on December 31, 2021, and expanded to include select sub-populations on January 13, 2022).[21]

- Analysis of available COVID-19 wastewater surveillance data suggests the Omicron wave may have recently peaked in Ontario.[22]

- Between December 20, 2021 (the week Omicron accounted for ~90% of sequenced cases in Ontario) and January 24, 2022, there have been 349,263 PCR-confirmed SARS-CoV-2 infections in Ontario which represents 2.3% of Ontario's population. [16,18] Due to changes to PCR testing availability, this is an underestimate of actual Omicron infections, far greater than the underestimates of infections generated from confirmed case data in earlier waves of the pandemic.

    - Despite underestimates, the majority of Ontario's population have not been infected with Omicron (noted above), meaning they remain susceptible to Omicron infection due to its ability to evade vaccine and prior infection-induced immunity, and evidence suggesting third dose immunity can wane quickly depending on the vaccine schedule and platform technology.[23] Nonetheless, COVID-19 vaccinations are providing considerable protection to Ontarians and the health care system.[24]

- For most of the summer and fall of 2021, the COVID-19 hospitalization rate remained ≤0.3 per 100,000.[25] On December 1, 2021, the hospitalization rate (includes all cases reported as ever being hospitalized during their infection) was 0.2 per 100,000, increasing to 0.8 on December 31, 2021, and 1.4 on January 16, 2022. Due to the lag between infection and hospitalization, as well as reporting delays, it is unclear at this time if Ontario's hospitalization rate is increasing or decreasing based on this data source. Prior to the Omicron wave, the highest COVID-19 pandemic hospitalization rate in Ontario was 1.8 per 100,000 on April 15, 2021.

    - National modelling suggests that new daily hospital admissions are forecast to surge in January and February 2022, given extremely high levels of Omicron transmission.[26]

    - The Ontario Hospital Association (OHA) reports that the weekly average number of COVID-19 patients (confirmed and suspected) in hospital continues to increase.[27] The number of COVID-positive individuals hospitalized in Ontario increased from 1,314 on January 1, 2022 to 4,061 on January 20, 2022.[28]

    - As of January 24, 2022, Ontario's intensive care unit (ICU) occupancy was at 80.6% for adults (454 funded adult ICU beds remaining), and 54.3% for pediatrics (48 funded pediatric ICU beds remaining). Funded ICU capacity reported by OHA may not reflect capacity in the system in skilled staff such as critical and acute care nursing, which may reduce the capacity to provide care to the remaining funded beds.[27]

- As of January 23, 2022, there were 402 ongoing outbreaks in long-term care homes, 302 in retirement homes, 532 in congregate living settings, and 235 in hospitals.[29]

    - From week 52 of 2021 to week 1 of 2022, there was a 110.1% increase in the number of cases of COVID-19 associated with LTC outbreaks among residents and a 41.2% increase in deaths among LTC residents.[1] As of January 23, 2022, nearly 60% of Ontario's LTC homes were in active outbreak.[30]

- As part of provincial response to Omicron, on December 19, 2021, Ontario introduced increased public health measures (i.e., reduced capacity in restaurants, reduced private gathering sizes) and further restricted measures on December 31, 2021 and January 3, 2022.[31-33] The flattening of the curve based on some indicators three to four weeks after measures were implemented suggests effectiveness of the measures in reducing contacts and decreasing transmission.

Challenges of applying experiences with Omicron in other jurisdictions to Ontario

South Africa

- Data from South Africa may not be generalizable to the Ontario context, due to differences in SARS-CoV-2 cumulative infection rate, low vaccination rates (i.e., 39% of adults fully vaccinated in South Africa by end December 2021), and their younger demographic.[34-36] If the Omicron BA.2 strain emerges and displaces BA.1 in Ontario, as is happening in Denmark, this may also make the South African Omicron wave less relevant to our context.

- Officials in South Africa have announced COVID-19 cases are decreasing in all provinces, suggesting the Omicron wave peaked.[37,38] Data from South Africa suggests that their Omicron waves peaked rapidly, at around four to six weeks from initial identification.[10,39] The highest weekly incidence in week 2 of 2022 was detected in the ≥80-year age group (142.3 cases per 100,000 persons).[40] In addition to the usual delays associated with mortality data, the South African National Department of Health reported that due to an ongoing audit exercise, there may be a backlog of COVID-19 mortality cases reported.[41,42] As of January 18, 2022, there is limited and inconsistent data available from South Africa to provide a reliable mortality trend associated with the Omicron variant in recent weeks.

- In response to Omicron, South Africa retained its lockdown at 'adjusted level 1', which is the least restrictive level of their five-tier system that includes mandatory face masks, public gathering limits, curfew, and limiting the serving of alcohol to before 11:00pm.[43] Of note, from December 9, 2021 to January 12, 2022, schools in South Africa closed as part of the planned term break.[44] Following a 29.7% decrease in the number of new cases detected in the week ending December 25, 2021 (89,781 cases, compared to the previous week's 127,753 cases), on December 30, 2021 South Africa lifted some of its measures, including changes to indoor capacity limits and curfew.[42]

Other Jurisdictions

- The jurisdictions PHO usually tracks for COVID-19 epidemiology and programming due to comparable caseloads, vaccine coverage etc. have not yet reported a clear downward slope of their Omicron waves (e.g., England, Denmark). These jurisdictions continue to report record high numbers of cases and hospitalizations. Currently, these jurisdictions are not helpful for anticipating the trajectory of the Omicron wave because they are not much further along than Ontario. Please refer to **Appendix C** for Omicron epidemiology, vaccine coverage and public health measures in England, Denmark, New York State and Chicago.

Epidemiological Scenarios for Winter 2022 in Ontario

Table 1 below summarizes three epidemiological scenarios of practical public health relevance to Ontario, January through March 2022. Likelihood of the scenarios can be further corroborated with modelling predictions.[2] In the following section, we further outline rationale and considerations for each potential scenario, with corresponding public health actions for consideration. In the context of a reopening plan announced for January 31, 2022, the following scenarios aim to provide considerations for downstream context and impacts of reopening in February and March 2022.[45]

Table 1. Summary of Scenarios for Winter 2022 in Ontario

Scenario	Drivers and impact	Risk level	Actions to mitigate
Incomplete decline and resurgence upon lifting of measures	Context: Moderate likelihood that large proportion of population susceptible to Omicron, alongside removal of some public health measures. Impact: High impact with inadequate time for health system recovery followed by resurgence is expected to lead to increasing admissions to hospital and ICU, health care worker absences, and continued strain on the healthcare system. Risk for increased restrictions needed on scheduled care thus increased indirect morbidity and mortality.	High	Re-implement broad public health measures across multiple higher risk settings to maintain priority and essential functions of society
Plateau at a moderate-to-high rate of transmission	Context: High likelihood that moderate-sized proportion of population susceptible to Omicron, alongside removal of some public health measures. Impact: Moderate impact with ongoing admissions to hospital and ICU, health care worker absences. Continued strain on healthcare system and limited ability for resumption of scheduled care, leading to indirect morbidity and mortality.	High	Pause reopening and consider re-implementing public health measures in some settings to reduce contacts
Steady but slow decline in transmission	Context: Moderate likelihood that lower proportion of population susceptible while public health measures are removed, and infection rate slowly declines. Impact: Moderate impact with slowly improving COVID-19-related admissions to hospital. Strain on healthcare system improves at slow rate.	Moderate	Slow relaxation of measures with three to four weeks of data to inform each stage of reopening, for monitoring

Scenario: Incomplete decline in transmission and resurgence upon lifting of some public health measures

- **Drivers:** Likelihood is moderate with a large proportion of the population remaining susceptible to Omicron, after some public health measures are lifted, and/or changes in population risk perception resulting in shifts in behaviour (e.g., increase in contact rates).

- **COVID-19-related risks:** Higher impact scenario with the incomplete decline in case growth leading to inadequate time for health system recovery (i.e., inability to resume scheduled care such as surgeries). Resurgence is expected to result in health care system impacts such as increased rate of admissions to hospital and ICU, challenges for the health care system workforce including absences, and increased indirect morbidity and mortality (e.g., cancellation of surgeries, delayed admissions).[46-48] **Overall risk level for this scenario is high (moderate likelihood X high impact).**

- **Response may include, but not limited to:** Re-implement broader community-based public health measures to reduce contacts, protect health system capacity, and reduce COVID-19 introductions into essential settings (i.e., schools, grocery stores and other essential workplaces), and minimize disruptions to in-person learning in schools and child-care settings.

    - Public health measures to consider include remote work for non-essential workplaces, private gathering limits, and closure or reduced capacity in higher risk indoor settings such as food/drink, sport/recreation, and non-essential retail.

    - Maintain community masking policies, physical distancing and expand the province's proof of vaccination program to account for third doses in indoor public settings. Optimize evidence-informed, tailored vaccination outreach and expand use of RATs.

Scenario: Plateau at a moderate-to-high rate of transmission

- **Drivers:** Likelihood is high with a moderate proportion of the Ontario population susceptible to Omicron (due to recovery from Omicron infection and increased uptake of third vaccine doses), and some public health measures are removed leading to increased contact rates.

- **COVID-19-related risks:** A plateau for several weeks to one to two months would have important impacts to the health system. Impacts to the health system would be characterized as moderate, with a prolonged plateau at a higher rate of transmission than previous waves leading to ongoing hospital and ICU admissions, health care worker absences and strain on the health care system. Increased indirect morbidity and mortality as a result of health care system compromise (e.g., limited ability to resume scheduled care and surgeries, delay to hospital ward admissions) would continue to be expected.[46] **Overall risk level for this scenario is high (high likelihood X moderate impact).**

- **Response may include, but not limited to:** Pause further reopening after January 31, 2022 if lack of improvement in trends two weeks after reopening. Aim would be to maintain or increase public health measures to reduce contacts, improve health system capacity, reduce COVID-19 introductions into essential settings (e.g., schools, grocery stores and other essential workplaces), and minimize disruptions to in-person learning in schools and child-care settings.

    - Strengthening measures can include reduced capacity limits in some public settings and enhanced protection measures in schools and essential workplaces.[49] Maintain community masking, physical distancing and expand the province's proof of vaccination program to account for third doses in indoor public settings. Optimize evidence-informed, tailored vaccination outreach and expand use of RATs.

Scenario: Steady but slow decline in transmission

- **Drivers:** Likelihood is moderate and could occur if the proportion of the population that is susceptible slowly declines (e.g., increased third dose coverage), as public health measures are removed and contact rates increase.

- **COVID-19-related risks:** In this scenario, impacts to health system would be moderate and expected to lessen over time with a slow rate of improvement in hospital and ICU admissions, with some continued strain and indirect morbidity and mortality until hospital capacity stabilizes so that scheduled surgeries can resume at a stable rate. **Overall risk level for this scenario is moderate (moderate likelihood X moderate impact).**

- **Response may include but not limited to:** Gradual removal of measures, with three to four weeks between each stage of reopening and ensuring two weeks before assessing relevant indicators, in order to accurately gauge the impact of the previous stage of reopening.[50] Reopening should prioritize mitigating transmission in "essential" settings (i.e., schools, essential workplaces). Maintain less restrictive measures such as community masking, physical distancing and expand the province's proof of vaccination program to account for third doses in indoor public settings. Optimize evidence-informed, tailored vaccination outreach and expand use of RATs.

Considerations for Winter 2022

Tracking the impact of lifting measures, and possible resurgence

- As public health measures are lifted, the resulting infections and illness would be monitored to ensure the data are consistent with the expected trends, remain manageable for the health system and do not risk the stability of critical infrastructure, including in-person learning.

- As noted above, traditional ways of looking at the data will not be possible due to changes in testing. Test-based metrics (e.g., case incidence) are currently an underestimate due to the testing strategy, and when it is updated, test-based metrics will continue to be a challenge to interpret for some time, until they stabilize. Some metrics (e.g., percent positive) can be useful once testing stabilizes, but other metrics (e.g., hospitalization) or new methodologies (e.g., wastewater) will need to be considered. The changes to testing strategy also make modelling more challenging as new data sources will require the development of new models.

- While detailed advice on surveillance is out of scope for this document, the following areas are opportunities to track the trajectory of the Omicron post-peak period and identify possible resurgence: cases and percent positivity, outbreaks in **c**ongregate living settings, disease severity (e.g., hospitalizations, ICU), outbreaks and/or number of individuals screened out of schools and workplaces, and health system capacity. Some of these signals are not currently tracked in Ontario (i.e., school outbreaks, symptom screening in workplaces); however, they may be considered for ongoing surveillance and monitoring. Please see **Appendix D** for examples of each.

Evidence-informed public health approach to removing measures

- **Gradual lifting of measures, using a phased approach, with monitoring of key public health and health care systems indicators** is important for avoiding resurgence. Evidence suggests there is a three to four week delay in the effect of lifting public health measures, therefore three to four weeks of data need to be monitored after lifting measures.[50] Of note, if relying on hospitalization data due to limitations in testing availability, this would require additional time due to the lag in hospital reporting.

    - Prioritize "essential" settings (e.g., schools, essential workplaces) during reopening with close monitoring. For example, the week of January 17, Ontario schools re-opened for in-person learning. Schools are part of critical infrastructure, and threats to the stability of in-person learning is associated with high long-term societal costs. Waiting to lift further measures will also allow more Ontarians to be vaccinated, and will reduce the height of the accompanying bump in cases/hospitalizations (i.e., if measures are lifted lower on the downward slope, the resulting cases/hospitalizations will be that much lower).

- **Update policies and programming as the evidence and context change.**

    - Evidence shows that **three doses of a COVID-19 vaccine provides greater protection against severe outcomes of Omicron variant infection compared to two doses**, making three dose vaccinations a key public health tool. To retain the purpose and effectiveness of vaccine certificates, they should indicate the bearer has the optimal vaccine effectiveness available to them. To prevent inequities, all eligible individuals require support to access third (or fourth) doses. Vaccine certificate expiry dates will make the most use of such a system, and ensure the system is ready for use when needed (e.g., rapid emergence of a high risk VOC).

- **Evidence supports aerosol transmission of SARS-CoV-2, and masking has been an important public health measure throughout the pandemic.**[51] A mask that optimizes fit and filtration, including the use of respirators in community settings, that can be worn correctly and comfortably by the general public can enhance the current public health measures. Improved access to higher quality masks, while maintaining mask mandates can help reduce COVID-19 incidence.[52] The scientific literature supports mask wearing in community settings as an effective means of SARS-CoV-2 source control, with an overall reduction in transmission risk when both source and contact are correctly wearing masks.[53]

- **Recent evidence shows that vaccinated individuals infected with Omicron continue to shed virus up to 10 days after diagnosis or symptom onset**.[54] Decisions in several jurisdictions to reduce the isolation period from ten to five days were based on 1) the evidence available at that time, and 2) critical workforce shortages.[55] As the evidence and context changes, case and contact management approaches may be considered given that potentially infectious individuals may be permitted access to settings where there is a risk of a high number of exposures.

- **Valid and reliable epidemiology is needed** to identify when an epidemic wave has peaked. Allowing time to identify and understand the best indicators of Omicron cases and disease given recent changes to testing and case and contact management, will support evidence-informed identification of the Omicron peak and post-peak trajectory in Ontario. Triangulation across indicators if relying on proxy measures of cases (e.g., wastewater), will provide greater confidence if they all indicate a decline.

- **Measures should adopt a layered approach, including a combination of public health measures** (e.g., vaccination, screening, surveillance), **environmental measures** (i.e., ventilation), **and personal measures** (e.g., wearing well-fitting and well-constructed masks and avoiding the "3 C's" –closed spaces, crowded places, and close contact).[56] Winter weather means more individuals are spending time in indoor 3C settings, making other measures even more important.

- Exercise caution to **avoid the "risk of overly optimistic statements regarding the state of the pandemic"**, a challenge faced by decision-makers during the Omicron response, according to the World Health Organization's International Health Regulations Emergency Committee.[3]

- There are **evidence-based behavioural science approaches to support enhanced uptake and adherence to public health measures**, specifically physical distancing and mask wearing.[57] Promising strategies to increase effective masking and physical distancing include persuasion (i.e., framing messages in terms of maintaining well-being rather than avoiding risk), enablement of the behaviour, modelling the behaviour, and clear education.

Minimizing inequities

- Use measures that protect communities experiencing disproportionate morbidity and mortality. Long-term care workers, essential workers, and racialized communities are among the groups that have experienced disproportionate COVID-19 morbidity.[58,59] An equity lens can ensure winter planning does not disproportionately impact these populations. Centralized, provincial responses to COVID-19 should accompany local interventions that consider equity and high-priority communities disproportionately affected by COVID-19 and associated restrictions (e.g., identify priority communities for provision of high quality masks, supporting vaccine uptake).[59]

- Implement a permanent, evidence-informed universal paid sick leave policy, with an adequate number of days of compensation (i.e., at least seven days of paid emergency leave on a permanent basis).[60] Universal paid sick leave is an evidence-based approach to addressing gaps in access to paid sick leave, leading to positive outcomes for health, equity and the economy.[60] An Ontario modelling study estimated that expanded access to 10 days of paid sick leave during the pandemic reduced total numbers of COVID-19 cases, reduced the presence of workers with SARS-CoV-2 at workplaces, and mitigated wage loss experienced by workers.[61]

- Maintain measures that support the stability of key social functions, including in-person learning, minimizing illness among front-line workers, and the provision of scheduled healthcare for non-COVID-19 conditions.

- Ethical frameworks developed to guide pandemic preparedness can support current planning in Ontario to foster equitable decision-making, public transparency, and social cohesion.[62]

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Appendix A: Winter/spring context throughout the pandemic in Ontario

Table A1 below summarizes the situation in Ontario across the winter/spring period in 2021 and the current provincial context (prior to lifting measures on January 31). In winter/spring, colder weather has implications for several public health measures (i.e., increased potential for indoor gatherings due to cold weather)

This table does not cover the Delta (B.1.617.2, first identified in India) VOC period in Ontario. The table captures winter/spring context in Ontario, and Delta's dominance in Ontario was in summer 2021.

Table A1. VOC, vaccine coverage, outcomes and measures in Ontario during winter/spring 2021

Characteristic	Winter 2021 (January/February 2021)	Spring 2021 (April/May 2021)	Winter 2022 (January 2022)
VOC	Wild type	Alpha (B.1.1.7) dominance	Omicron (B.1.1.529) dominance
Vaccine Administration	Vaccination: first dose for select populations beginning	Vaccination: first dose continues	Vaccination: 5-11 first dose; 5-11 second dose roll-out beginning (8 week interval); 18+ boosters
Outcomes (PHO Data Tool)[18]	Peak weekly case rate: 168 cases per 100,000 (January 3-9, 2021) Peak weekly hospitalization rate: 6.7 hospitalizations per 100,000 (January 3-9, 2021) Peak weekly death rate: 2.9 deaths per 100,000 (January 17-23, 2021)	Peak weekly case rate reported on April 17, 2021: 209 cases per 100,000 (April 11-17, 2021) Peak weekly hospitalization rate: 10.6 hospitalizations per 100,000 (April 11-17, 2021) Peak weekly death rate: 1.5 deaths per 100,000 (April 18-24, 2021)	Weekly case rate: 668.8 cases per 100,000 (Dec 26, 2021 to Jan 1, 2022) Weekly hospitalization rate: 11.5 hospitalizations per 100,000 (Jan 9-15, 2022) Weekly death rate: 2.0 deaths per 100,000 (Jan 9-15, 2022)

Characteristic	Winter 2021 (January/February 2021)	Spring 2021 (April/May 2021)	Winter 2022 (January 2022)
Response	Stay-at-home order Jan 16 to Feb 10, 2021. Regional entry into colour-coded framework Feb 10, 2021 (with Toronto, Peel and York remaining in Stay-at-Home until Feb 22). Measures were subject to change based on case rate, reproduction number, outbreaks, hospital capacity, CCM.[63]	Stay-at-home order April 7, 2021, followed by entry into step one of Roadmap to Reopening June 11, 2021. Measures were subject to change based on vaccination coverage and public health indicators.[63]	As of January 5, 2022, Ontario entered modified step two measures until January 31, 2022, subject to trends in public health and health system.[33]

Appendix B: Measures in Ontario at Select Time Points

Table B1. Relaxation of public health measures from lockdown/Stay-at-Home order at select time points in Ontario

Sector/ Type of measure	February 2021:[64,65] Red and orange measures in the COVID-19 Response Framework	June 11, 2021:[63] Step one Roadmap for Reopening	June 30, 2021:[63] Step two Roadmap for Reopening	January 2022:[33] Modified Step two
General	Most regions exited the Stay-at-Home order on Feb 16, 2021 into Orange-restrict or Red-control, with Toronto, Peel and York exiting the stay-at-home order on Feb 22, 2021.	To exit the Stay-at-Home Order implement on April 8, Ontario entered step one June 11, 2021 (based on 60% of Ontario receiving at least one-dose and public health indicators).	Ontario entered step two on June 30, 2021 (based on 70% of Ontario receiving at least one dose, 20% receiving both doses, and public health indicators).	As of January 5, 2022, Ontario implemented modified step two measures (originally until January 27, amended to January 31).
Face coverings	Red-Control: Required in all indoor public settings. Orange-Restrict: Required in all indoor public settings.	Required in public indoor settings, and when physical distancing is a challenge.	Same as June 11	Same as June 11
Gathering limits	Red-Control: 10 indoors, 25 outdoors. Orange-Restrict: 10 indoors, 25 outdoors.	Outdoor gatherings limited to 10.	Outdoor gatherings limited to 25; indoor limited to 5.	Outdoor gatherings limited to 10; indoor limited to 5.
Food/ drink	Red-Control: Same as orange with the following additions—10 patrons permitted indoors; Outdoor dining, take out, drive through, and delivery permitted.	Indoor dining not permitted. Outdoor dining limited to 4.	Indoor dining not permitted. Outdoor dining limited to 6.	Indoor dining not permitted. Outdoor dining with restrictions.

Sector/ Type of measure	February 2021:[64,65] Red and orange measures in the COVID-19 Response Framework	June 11, 2021:[63] Step one Roadmap for Reopening	June 30, 2021:[63] Step two Roadmap for Reopening	January 2022:[33] Modified Step two
	Orange-Restrict: 50 patrons permitted indoors and a limit of four people may sit together. All settings close by 10:00pm, no consumption of alcohol after 9:00pm, screening of all patrons required.			
Sport/ recreation	Red-Control: maximum capacity of 10 indoors (classes), 25 outdoors (classes), 10 indoors (weight/equipment). Screening, limited duration of 90 minutes, no spectators. Orange-Restrict: maximum of 50 people per facility. Screening, limited duration of 90 minutes, no spectators.	Indoor closed. Outdoor fitness up to 10. Outdoor pools open with distancing.	Same as June 11; outdoor sport leagues permitted.	Indoor closed. Outdoor settings permitted (i.e., rinks).
Events/ entertainment	Red-Control: Measures from orange but with stricter capacity limits – 10 people indoors, 25 people outdoors. Orange-Restrict: Maximum 50 people per facility, all settings must close at 10:00pm. Screening of all patrons required.	Closed	Outdoor cinemas, performing arts, amusement parks, water parks with capacity limits.	Closed
Retail	Red-Control: Limit of 10 people indoors in food courts.	Non-essential retail 15% capacity.	Non-essential retail at 25% capacity; essential retail at 50% capacity.	Retail settings permitted 50% capacity (including malls). For malls – physical distancing required in line-

Sector/ Type of measure	February 2021:[64,65] Red and orange measures in the COVID-19 Response Framework	June 11, 2021:[63] Step one Roadmap for Reopening	June 30, 2021:[63] Step two Roadmap for Reopening	January 2022:[33] Modified Step two
	Orange-Restrict: Screening of all patrons at mall entrance. Limit capacity, limit volume of music, enforce distancing.	Essential retail at 25% capacity. Malls closed.		ups, loitering not permitted, food courts closed. Sale of alcohol stops at 10:00pm, and on premise consumption of alcohol stops at 11:00pm.
Personal care	Red-Control: All services requiring removal of masks prohibited. Orange-Restrict: All services requiring removal of masks prohibited. Change rooms, showers, pools, hot tubs closed.	Closed	Open with capacity limits and face coverings at all times.	Permitted at 50% capacity and other restrictions. Saunas, steam rooms, and oxygen bars closed.
Casino/ gaming	Red-Control: limit of 10 people indoors, 25 people outdoors. Orange-Restrict: Screening, no liquor consumption after 10:00pm.	Horse racing and motor speedways open without spectators	Same as June 11.	Outdoor establishments open at 50% capacity.

Appendix C: International Omicron Context

United Kingdom (England)

- **Omicron Epidemiology:** On January 21, 2022, rate of cases was 996 per 100,000 people, which represents a 0.7% change in the previous 7-day case rate.[66] The United Kingdom Health Security Agency (UKHSA) reported that 95% of a representative sample of specimens were Omicron (based on identification of SGTF) in the last week of December 2021.[67]
    - On the week ending January 9, 2022, the hospital admission rate of COVID-19-confirmed patients in England was at 19 per 100,000 people (up from 10 per 100,000 on December 26, 2021).[68]
    - On January 13, 2022, the UKHSA weekly vaccine surveillance report estimated that vaccine effectiveness against symptomatic disease with Omicron is significantly lower when compared to Delta, and wanes rapidly.[68] However, protection against hospitalization remains high, particularly after three doses.[69]
- **Public Health Measures:** "Plan B" measures in response to Omicron consist of mask mandates in most indoor settings, remote work wherever possible and an immunity certificate (National Health Service pass) is required to enter several public settings for all individuals age 18 or older.[70]

Denmark

- **Omicron Epidemiology:** Cases have not yet begun to decline in Denmark, where Omicron variant represents >90% of the confirmed SARS-CoV-2 cases.[71] The 7-day rolling average of new cases was 397 per 100,000 on January 16, 2022 (up from 73 per 100,000 on December 1, 2021).[72]
    - As of January 19, 2022, hospitalizations and ICU admissions are still on the rise in Denmark.[73]
    - As of January 18, 2022, vaccine coverage in Denmark was 80.2% (4,709,594) of the population received two doses and 57.1% (3,382,254) received three doses of the COVID-19 vaccine.[73]
- **Public Health Measures:** Measures in response to Omicron include mask mandates in all indoor settings, introduction of capacity limits, temporary closures of schools, cancellation of large events, and recommending remote work. An immunity certificate is also required to enter various settings and was made more restrictive (i.e., shortening how long a negative test result is valid for) in the Omicron context.[74]

New York State

- **Omicron Epidemiology:** On January 20, 2022, the 7-day case rate was 144 per 100,000 (down from 366 per 100,000 on January 7, 2022).[75] This case rate is still considerably higher than various "peak" case rates in New York throughout the pandemic (i.e., 48 per 100,000 in April 2020; 83 per 100,000 in January 2021).
    - On January 17, 2022, the 7-day average of total COVID-19 patients admitted to hospital was 62.06 per 100,000; on this same day, the 7-day average of *new* hospital admissions was 8.29 per 100,000.[76]
    - On January 18, 2022, 83.7% of the population in New York State (18 years or older) received two doses of the COVID-19 vaccine (which corresponds to 73% of the total population in the state).[77]
- **Public Health Measures**: Mask mandates in indoor settings and workplace-specific mandates (e.g., New York State made a booster dose a requirement for healthcare workers).[6,74]

Chicago, Illinois

- **Omicron Epidemiology:** On January 19, 2022, the daily average cases reported in Chicago is 2,903 cases, which represents 107.3 daily cases per 100,000.[78]
    - On January 19, 2022, the daily average COVID-19-confirmed hospitalizations was 196 hospitalizations, which represents 7.2 daily hospitalizations per 100,000.[78]
    - As of January 19, 2022, only 65.8% of Chicago's population (18 years or older) had completed their COVID-19 vaccination series.[78]
- **Public Health Measures:** Masks are still mandatory indoors. Effective January 3, 2022, any individual 5 years of age or older will be required to show proof that they are fully vaccinated against COVID-19 to dine indoors, visit gyms, or enjoy entertainment venues where food or drink are being served.[79]

Appendix D: Tracking impact of public health measures

Some of the metrics below will be limited by the current PCR testing strategy (e.g., breakthrough cases in people who are not eligible for PCR will not be detected, which will bias the demographic analyses), and reporting policies (e.g., school cases and outbreak reporting).

Table D1. How to track the impact of changes to public health measures on SARS-CoV-2 burden, and possible resurgence

Category	Examples
Cases and test positivity	Case incidence; test positivity; breakthrough cases (waning immunity or immune evasion). Demographic characteristics of breakthrough cases (e.g., age, marginalization index, neighbourhood etc.), and other potential vulnerabilities (e.g., co-morbidities), can provide insight into where to focus vaccination and other preventive efforts, and could identify changes in SARS-CoV-2 virology (i.e., attenuation). Undetected cases can result in transmissions and impair outbreak recognition.
School and childcare signals* *because children <5 years of age remain unvaccinated, it is possible a larger proportion of SARS-CoV-2 will shift to both this population and children ≥5 years of age who remain unvaccinated or have not received two doses	School closures, absenteeism (details to be determined)[80]
Congregate living settings** **retirement homes, long-term care, shelters, and others	Number of outbreaks, closures due to outbreaks in long-term care, congregate settings, hospitals, and other workplaces.
Disease severity	Rates of COVID-19-related hospitalization, ICU occupancy, mechanical ventilation, duration of stay in hospital, deaths, excess deaths.
Health system capacity	Return to providing elective surgery is a signal of improved health system capacity. Directive 2 stopped elective surgeries in Ontario to protect health human resources, and a return to this standard of care is critical to mitigating excess morbidity and mortality in Ontario.

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Ontario