Public Health Ontario | Santé publique Ontario

ENHANCED EPIDEMIOLOGICAL SUMMARY

(Archived) Early Estimates of Omicron Severity in Ontario based on a Matched Cohort Study of Cases occurring between November 22 and December 24, 2021

Published: January 2022

Archived: September 2022

Purpose

We used data from Ontario's Public Health Case and Contact Management Solution (CCM) linked to Ontario Ministry of Health's COVaxON application to examine hospitalizations and death rates associated with Omicron, as compared to closely matched patients infected with Delta.

For more information on the prevalence of Omicron in Ontario, please refer to PHO's weekly COVID-19 cases with Lineage B.1.1.529 (Omicron) or S-Gene Target Failure (SGTF) in Ontario report and the report on Early Dynamics of Omicron in Ontario. For more information on variants confirmed by whole genome sequencing, refer to PHO's SARS-CoV-2 Whole Genome Sequencing weekly report.

Background

The WHO designated Omicron as a Variant of Concern on November 26, 2021.[1] Omicron has more than 30 mutations in the spike protein, and it is now evident that Omicron is rapidly replacing Delta[2] due to increased levels of immune escape. It is less clear how the severity of Omicron compares to Delta. Early data from South Africa suggests that Omicron may be less severe;[3] however, the low average age, extent of previous infection, and low vaccination rates impact generalizability to other countries. In Ontario, we sought to examine rates of hospitalization, intensive care unit admission, and death associated with Omicron, as compared to matched patients infected with Delta.

Highlights

- Among matched Omicron cases with an onset date between November 22 and December 24, 2021:
    - 3/9,087 (<0.1%) matched Omicron cases died, compared to 26/9,087 (0.3%) Delta cases.
    - 53/9,087 (0.6%) matched Omicron cases were hospitalized or died, compared to 129/9,087 (1.4%) Delta cases.
    - 8/9,087 (0.1%) matched Omicron cases were admitted to ICU or died, compared to 42/9,087 (0.5%) Delta cases.
- For Omicron cases compared to Delta cases, the risk of hospitalization or death was 59% lower (hazard ratio, HR=0.41, 95%CI: 0.30, 0.55), while risk of ICU admission or death was 81% lower (HR=0.19, 95%CI: 0.09, 0.39) and risk of death was 88% lower (HR=0.12, 95%CI: 0.04, 0.37).
- Among unvaccinated cases, the risk of hospitalization or death was reduced by 59% for Omicron cases compared to Delta cases (HRunvaccinated=0.41, 95% CI: 0.26, 0.64). Among vaccinated cases with 2 doses, the risk of hospitalization or death was reduced by 56% among Omicron vaccinated cases compared to Delta vaccinated cases (HRvaccinated=0.44, 95% CI: 0.29, 0.65).
- Due to the increased transmissibility of Omicron, the absolute number of hospitalizations and impact on the healthcare system could still be significant, despite the probable reduction in severity.

Methods

We conducted a retrospective population-wide matched cohort study of patients infected with Omicron and Delta variants. Cases were included if onset occurred between November 22 (first Omicron case in Ontario) and December 24, 2021. Case onset date was defined by symptom onset, or for asymptomatic cases, specimen collection. Cases were excluded if they were missing onset date, age, gender, or were hospital-acquired.

Omicron cases included those identified by whole genome sequencing (WGS), S-gene target failure (SGTF) with cycle threshold ≤30 before December 13 (date of 50% Omicron prevalence),[2] and any SGTF on or after December 13. Delta cases included those detected by WGS, those with amplification of the S-gene, and all cases not identified as Omicron prior to December 3 (date of 5% Omicron prevalence).[2]

Omicron cases were matched to Delta cases using 1:1 matching on gender (male, female, other), age (0–4, 5–11, 12–18, 19–29, 30–39, 40–49, 50–59, 60–69, 70–79, 80+), vaccination status (0 doses, 1 dose, 2 doses, 3 doses), time since most recent dose (>14 days to <3 months for dose 1 or >7 days to <3 months for doses 2 and 3, , 3–6 months, ≥6 months), region and onset date (±3 days). Cox proportional hazards models accounting for clustering within matched sets were used to determine the hazards of hospitalization, intensive care unit (ICU) admission and deaths, compared to Delta cases. Due to

concerns around incidental SARS-CoV-2 findings upon hospital admission due to universal screening practices in hospitals, we conducted a separate sensitivity analysis excluding cases with first positive specimen collection on the day of or the day prior to hospitalization. Stratified analyses were performed to evaluate differences in risk by gender, age group, and vaccination status, as data permitted.

Results

We identified 37,296 Omicron cases that met eligibility criteria, of which 9,087 were matched with 1 Delta case (N=9,087, Table 1). The median (interquartile range [IQR]) follow-up time was 24 days (21.0, 28.0). There were 53 (0.6%) hospitalizations or deaths and 3 (0.03%) deaths among matched Omicron cases, compared to 129 (1.4%) hospitalizations or deaths and 26 (0.3%) deaths among matched Delta cases. The risk of hospitalization or death was 59% lower (hazard ratio, HR=0.41, 95%CI: 0.30–0.55, Table 2) in Omicron compared to Delta cases (Figure), the risk of ICU admission or death was 81% lower (HR=0.19, 95%CI: 0.09, 0.39) and the risk of death was 88% lower (HR=0.12, 95%CI: 0.04, 0.37). A sensitivity analysis excluding cases with potential incidental SARS-CoV-2 findings on hospital admission, also demonstrated reduced risk of hospitalization or death of Omicron relative to Delta (HR=0.33, 95%CI: 0.19, 0.56). Stratified estimates of Omicron severity by age, gender, and vaccination status all indicated reduced severity of Omicron (Table 2).

Table 1. Demographic characteristics, vaccination status, and outcomes among SARS-CoV-2 Delta and Omicron variant cases, and among matched cases (N, %).

	Full Cohort Delta N=24,432	Full Cohort Omicron N=37,296	Matched Cohort Delta N=9,087	Matched Cohort Omicron N=9,087
Age (median, [IQR])	33.0 [13.0, 49.0]	30.0 [21.0, 44.0]	32.0 [16.0, 46.0]	32.0 [17.0, 46.0]
Gender				
Female	12,038 (49.3)	18,682 (50.1)	4,571 (50.3)	4,571 (50.3)
Male	12,331 (50.5)	18,577 (49.8)	4,511 (49.6)	4,511 (49.6)
Other	63 (0.3)	37 (0.1)	5 (0.1)	5 (0.1)
Vaccination status (doses, and time since last dose)				
0 doses	10,900 (44.6)	4,784 (12.8)	2,823 (31.1)	2,823 (31.1)
1 dose				
>14d to <3 months	1,096 (4.5)	1,617 (4.3)	551 (6.1)	551 (6.1)
3–6 months	159 (0.7)	110 (0.3)	29 (0.3)	29 (0.3)
≥6 months	154 (0.6)	132 (0.4)	18 (0.2)	18 (0.2)
2 doses				
>7d to <3 months	509 (2.1)	865 (2.3)	162 (1.8)	162 (1.8)
3–6 months	3,392 (13.9)	8,714 (23.4)	1,724 (19.0)	1,724 (19.0)
≥6 months	6,183 (25.3)	17,102 (45.9)	3,146 (34.6)	3,146 (34.6)
3 doses				
>7d to <3 months	1,975 (8.1)	3,841 (10.3)	622 (6.8)	622 (6.8)
3–6 months	64 (0.3)	130 (0.3)	12 (0.1)	12 (0.1)
≥6 months	0 (0.0)	1 (<0.01)	0 (0.0)	0 (0.0)
Outcomes				
Hospitalization/death	689 (2.8)	115 (0.3)	129 (1.4)	53 (0.6)
ICU admission/death	248 (1.0)	21 (0.1)	42 (0.5)	8 (0.1)
Deaths	133 (0.5)	12 (<0.1)	26 (0.3)	3 (<0.1)

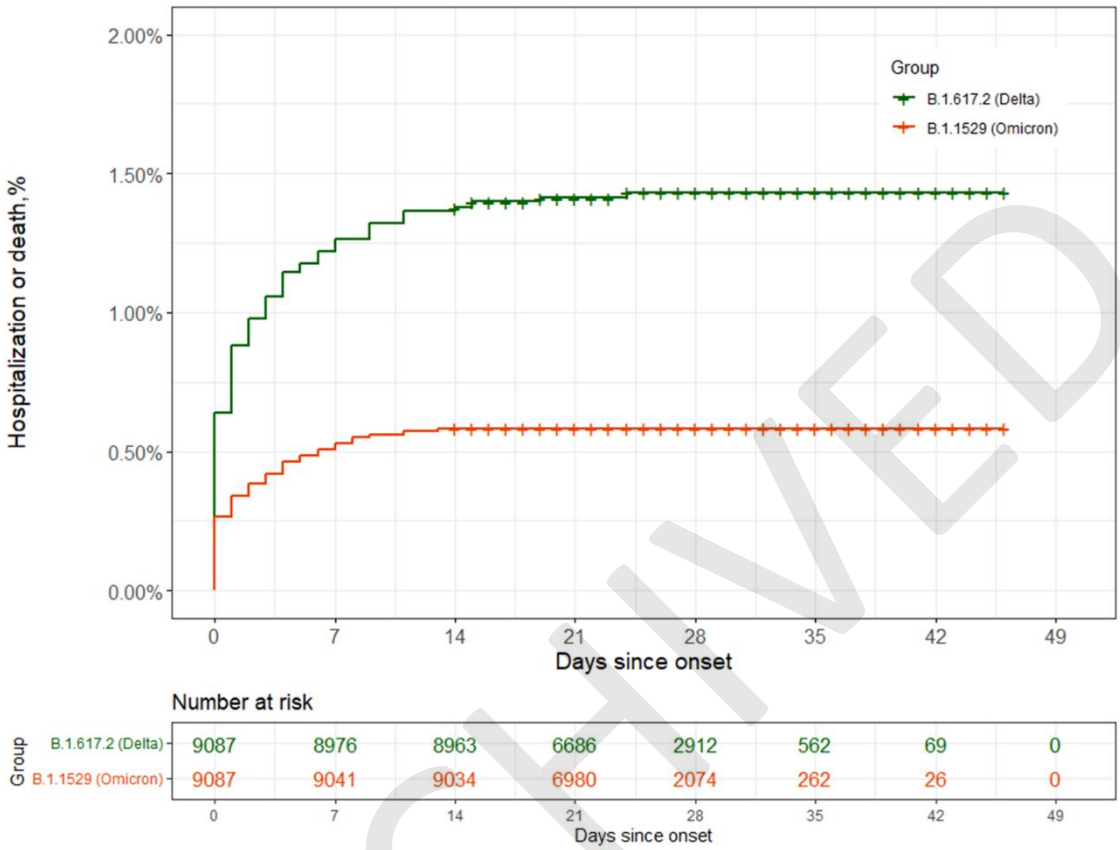
Note: d, days; IQR, inter-quartile range; ICU, intensive care unit

Table 2. Risk of hospitalization or death and intensive care unit admission or death associated with Omicron infection relative to Delta, Ontario, Canada.

	Delta N (%)	Omicron N (%)	Hospitalization or death, HR (95%CI)	ICU admission or death, HR (95%CI)	Hospitalization or Death, sensitivity analysis* HR (95%CI)
Total	9,087 (100.0)	9,087 (100.0)	0.41 (0.30, 0.55)	0.19 (0.09, 0.39)	0.33 (0.19, 0.56)
Stratified Analys					
Gender					
Female	4,571 (50.3)	4,571 (50.3)	0.47 (0.31, 0.73)	0.23 (0.07, 0.74)	0.61 (0.29, 1.29)
Male	4,511 (49.6)	4,511 (49.6)	0.36 (0.24, 0.54)	0.17 (0.07, 0.43)	0.18 (0.08, 0.41)
Age					
<60	8,215 (90.4)	8,215 (90.4)	0.42 (0.25, 0.70)	0.10 (0.01, 0.78)	0.47 (0.21, 1.05)
≥60	872 (9.6)	872 (9.6)	0.39 (0.28, 0.57)	0.21 (0.10, 0.46)	0.24 (0.11, 0.51)
Vaccine doses					
0 doses	2,823 (31.1)	2,823 (31.1)	0.41 (0.26, 0.64)	0.31 (0.13, 0.76)	0.21 (0.07, 0.61)
2 doses	5,032 (55.4)	5,032 (55.4)	0.44 (0.29, 0.65)	0.09 (0.02, 0.38)	0.40 (0.20, 0.80)

CI=confidence interval; HR=hazard ratio; ICU=intensive care unit; All analyses based on proportional hazards models, and presented as hazards ratios. Hazards ratios of 1 indicate equal risk for Omicron relative to Delta, <1 indicate reduced severity of Omicron, >1 indicate increased severity of Omicron.*sensitivity analysis excludes Delta or Omicron cases with potential incidental SARS-CoV-2 findings (first positive specimen collection on the day of or the day prior to hospitalization)

Figure 1. SARS-CoV-2 associated hospitalization or death among matched Omicron variant (N=9,087, orange line) and Delta variant cases (N=9,087, green line) cases as a function of days since onset.



Note: Date of onset was defined as symptom onset date, falling back to first positive specimen collection date in the absence of a documented symptom onset date.

Discussion

In this matched study of over 9,000 Omicron cases in Ontario, Canada, we found that the risk of hospitalization was 59% lower for SARS-CoV-2 cases infected with the Omicron variant relative to the Delta variant. Our results align with findings from South Africa, Scotland, England and southern California, all of which have demonstrated substantial decreases in risk of hospitalization associated with Omicron.[3–6] One early hypothesis for increased transmissibility with decreased severity is the increased replication in the bronchi but decreased replication in lung parenchyma.[7]

Omicron appears to demonstrate lower disease severity for both vaccinated and unvaccinated individuals. While severity is likely to be reduced, the absolute number of hospitalizations and impact on the healthcare system may nevertheless be significant due to the increased transmissibility of Omicron.

Limitations

This study has some limitations, in particular the short follow-up duration and potential misclassification due to incidental findings from hospital admissions screening, or incomplete public health follow-up as incidence increased. However, Omicron appears to be the first dominant variant to demonstrate a decline in disease severity. While severity may be reduced, due to the transmissibility of Omicron, the absolute number of hospitalizations and impact on the healthcare system is likely to be significant.

Data Sources

- The data for this report were based on information successfully extracted from the Public Health Case and Contact Management Solution (CCM) for all PHUs by PHO as of **January 10, 2022 at 1 p.m**. for cases reported from February 1, 2021 onwards and as of **January 10, 2022 at 9 a.m.** for cases reported up to January 31, 2021.

- COVID-19 vaccination data were based on information successfully extracted from the Ontario Ministry of Health's COVaxON application as of **January 10, 2022 at approximately 7 a.m.** COVaxON data was subsequently linked to COVID-19 case data based on information successfully extracted from the Public Health Case and Contact Management Solution (CCM) for all PHUs by PHO as of **January 10, 2022 at 1 p.m.**

References

1. Callaway E. Heavily mutated Omicron variant puts scientists on alert. Nature. 2021;600(7887):21. Available from: https://doi.org/10.1038/d41586-021-03552-w

2. Ontario Agency for Health Protection and Promotion (Public Health Ontario). Early dynamics of Omicron in Ontario, November 1 to December 16, 2021 [Internet]. Toronto, ON: Queen's Printer for Ontario; 2021 [cited 2021 Dec 24]. Available from: https://www.publichealthontario.ca/-/media/documents/ncov/epi/covid-19-early-dynamics-omicron-ontario-epi-summary.pdf

3. Wolter N, Jassat W, Walaza S, Welch R, Moutrie H, Grome M, et al. Early assessment of the clinical severity of the SARS-CoV-2 Omicron variant in South Africa. medRxiv 21268116 [Preprint]. 2021 Dec 21 [cited 2021 Dec 23]. Available from: https://doi.org/10.1101/2021.12.21.21268116

4. Ferguson N, Ghani A, Hinsley W, Volz E. Report 50: hospitalisation risk for Omicron cases in England [Internet]. London: Imperial College London; 2021 [cited 2021 Dec 23]. Available from: https://www.imperial.ac.uk/mrc-global-infectious-disease-analysis/covid-19/report-50-severity-omicron/

5. Sheikh A, Kerr S, Woolhouse M, McMenamin J, Robertson C. Severity of Omicron variant of concern and vaccine effectiveness against symptomatic disease: national cohort with nested test negative design study in Scotland [Internet]. Edinburgh: University of Edinburgh; 2021 [cited 2021 Dec 23]. Available from: https://www.research.ed.ac.uk/en/publications/severity-of-omicron-variant-of-concern-and-vaccine-effectiveness-

6. Lewnard JA, Hong VX, Patel MM, Kahn R, Lipsitch M, Tartof SY. Clinical outcomes among patients infected with Omicron (B.1.1.529) SARS-CoV-2 variant in southern California. medRxiv 22269045 [Preprint]. 2022 Jan 11 [cited 2022 Jan 14]. Available from: https://doi.org/10.1101/2022.01.11.22269045

7. Li Ka Shing Faculty of Medicine, the University of Hong Kong. HKUMed finds Omicron SARS-CoV-2 can infect faster and better than Delta in human bronchus but with less severe infection in lung [Internet]. Hong Kong; University of Hong Kong, 2021 [cited 2021 Dec 24]. Available from: https://www.med.hku.hk/en/news/press/20211215-omicron-sars-cov-2-infection

Citation

Ontario Agency for Health Protection and Promotion (Public Health Ontario). Early estimates of Omicron severity in Ontario based on a matched cohort study, November 22 to December 24, 2021. Toronto, ON: Queen's Printer for Ontario; 2022.

Disclaimer

This document was developed by Public Health Ontario (PHO). PHO provides scientific and technical advice to Ontario's government, public health organizations and health care providers. PHO's work is guided by the current best available evidence at the time of publication. The application and use of this document is the responsibility of the user. PHO assumes no liability resulting from any such application or use. This document may be reproduced without permission for non-commercial purposes only and provided that appropriate credit is given to PHO. No changes and/or modifications may be made to this document without express written permission from PHO.

Public Health Ontario

Public Health Ontario is an agency of the Government of Ontario dedicated to protecting and promoting the health of all Ontarians and reducing inequities in health. Public Health Ontario links public health practitioners, front-line health workers and researchers to the best scientific intelligence and knowledge from around the world.

For more information about PHO, visit publichealthontario.ca.

Ontario