

ENHANCED EPIDEMIOLOGICAL SUMMARY

The Impact of COVID-19 Booster Vaccination on Hospitalizations during Omicron: December 15, 2021 to March 27, 2022

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Introduction

This report describes the direct impacts of the COVID-19 vaccination program booster dose on hospitalizations in Ontario, with a focus on the period from December 15, 2021 onwards where Omicron was the dominant circulating strain. Data in this report include the most current COVID-19 case and vaccination information extracted from CCM and COVaxON, respectively, as of March 28, 2022 and describes cases and vaccinations reported up to March 27, 2022.

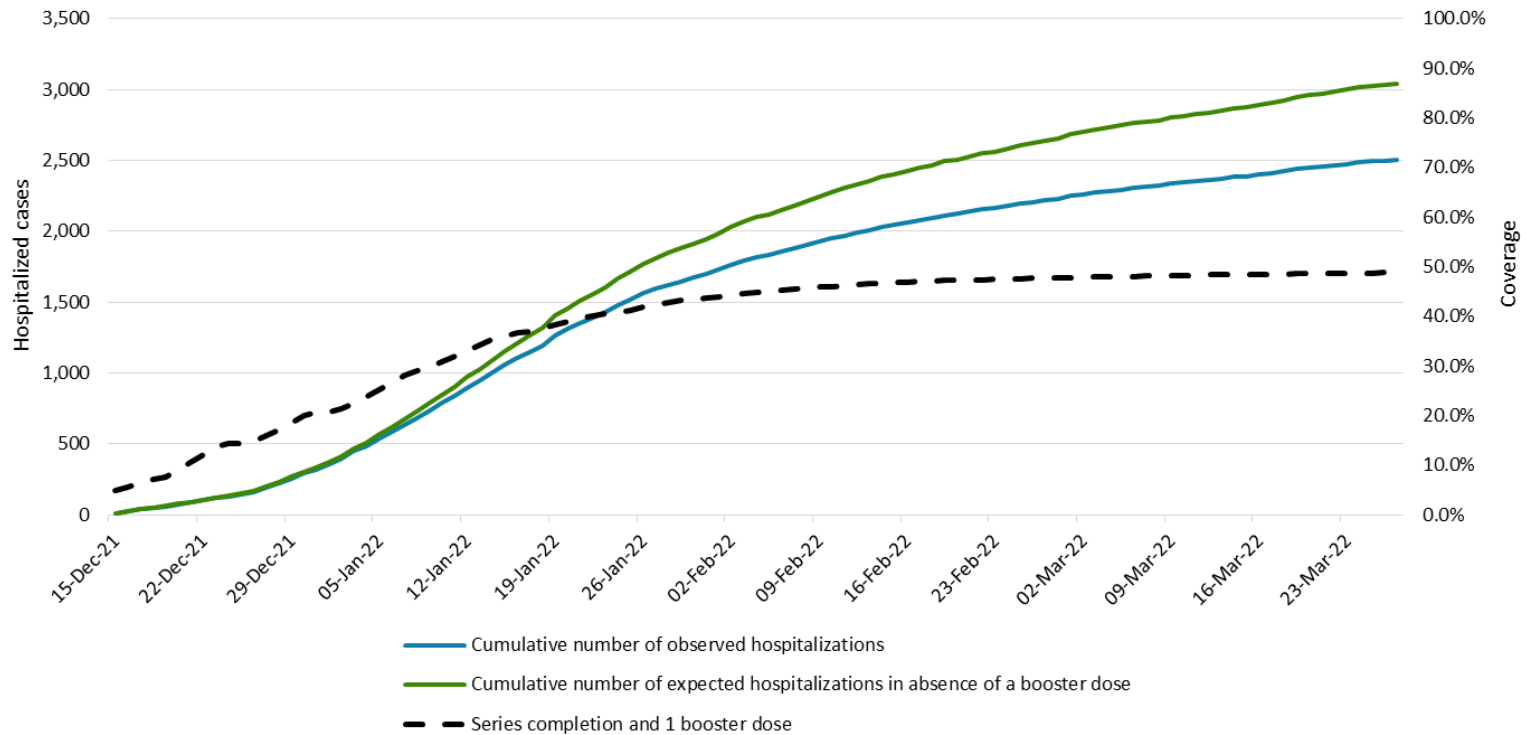
Please visit the COVID-19 Vaccine Uptake report and the interactive [Ontario COVID-19 Data Tool](#) to explore COVID-19 vaccination uptake data by public health unit, age group and trends over time. The report on [COVID-19 Vaccine Uptake in Ontario](#)¹ further describes vaccine uptake across the province.

Highlights

- Since December 15, 2021, when Omicron became the dominant circulating COVID-19 strain in Ontario, an estimated 5,848 hospitalizations have been prevented among individuals 18 years of age and older as a result of the direct effects of the booster vaccination program.
 - Of these an estimated 537 hospitalizations have been prevented among individuals 18-59 years of age ([Figure 1](#)).
 - An estimated 5,311 hospitalizations have been prevented among individuals 60 years of age and older ([Figure 2](#)).
- Since only the direct effects of vaccination are estimated in this analysis (e.g., indirect effects such as reduced transmission are not included) the reduction in hospitalizations are likely to be underestimated.

Vaccination Program Impact

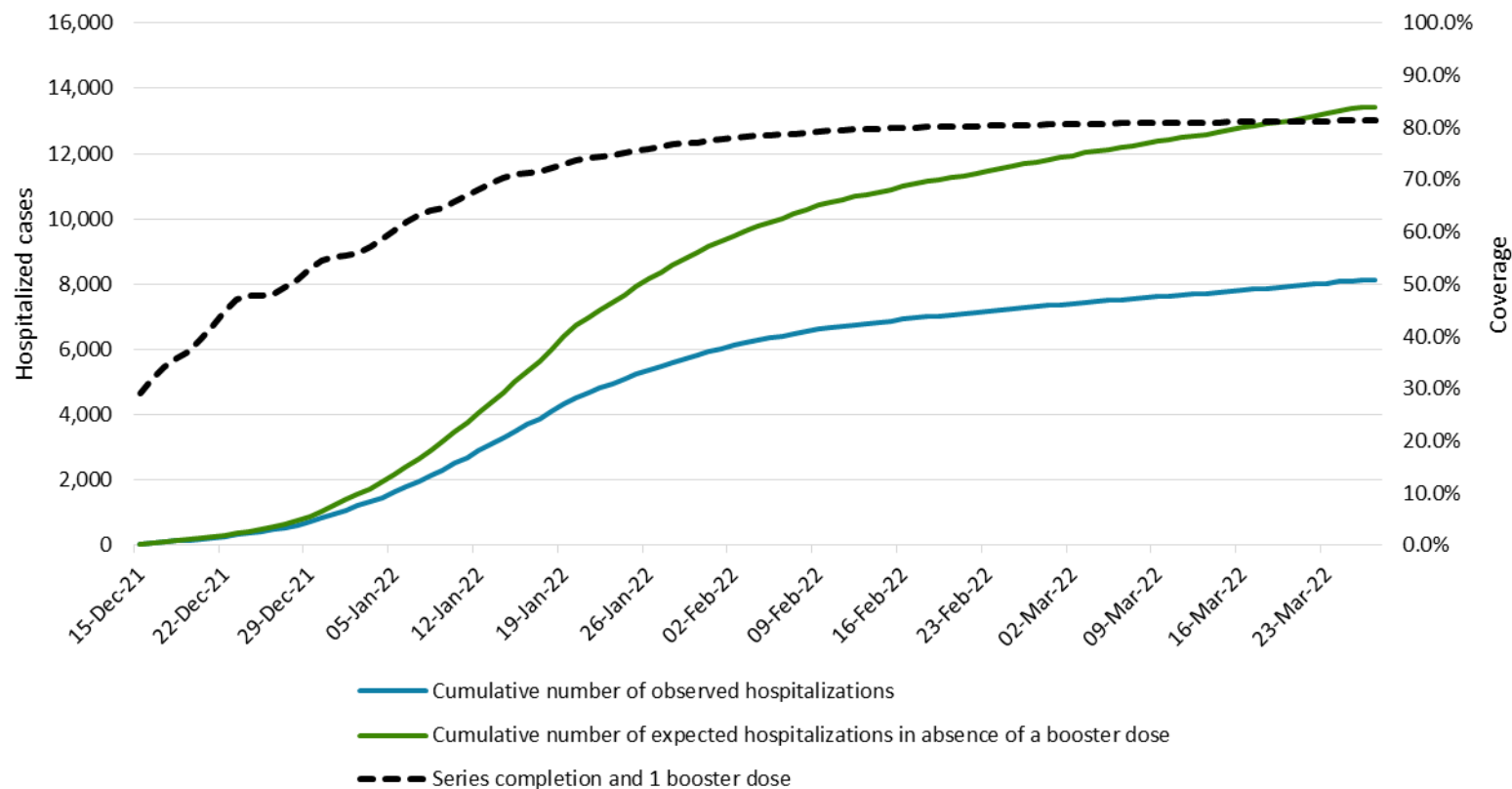
Figure 1. Observed number of COVID-19 hospitalizations and expected number of COVID-19 hospitalizations in absence of a booster dose among individuals 18-59 years of age: Ontario



Notes:

1. Only direct effects of vaccination on hospitalizations were estimated. Indirect effects, including reduced transmission as a result of vaccination were not estimated. As a result, the impact of the vaccination program on the reduction of severe outcomes is likely an underestimate.
2. Cumulative observed and expected hospitalizations include all hospitalized cases (unvaccinated, cases post-series completion, etc.).

Figure 2. Observed number of COVID-19 hospitalizations and expected number of COVID-19 hospitalizations in absence of a booster dose among individuals 60 years of age and older: Ontario



Notes:

1. Only direct effects of vaccination on hospitalizations were estimated. Indirect effects, including reduced transmission as a result of vaccination were not estimated. As a result, the impact of the vaccination program on the reduction of severe outcomes is likely an underestimate.
2. Cumulative observed and expected hospitalizations include all hospitalized cases (unvaccinated, cases post-series completion, etc.).

Technical Notes

Data Sources

- COVID-19 vaccination data were based on information successfully extracted from the Ontario Ministry of Health's COVaxON application as of **Mar 28, 2022 at approximately 7:00 a.m.** for vaccination records created on or after June 1, 2021 and **Mar 24, 2022 at approximately 7:00 a.m.** for vaccination records created up to May 31, 2021.
- COVID-19 case data were based on information successfully extracted from the Ontario Ministry of Health's CCM application as of **Mar 28, 2022 at approximately 1:00 p.m.** for cases reported from Feb 1, 2021 on and as of **Mar 24, 2022 at approximately 9:00 a.m.** for cases reported up to Jan 31, 2021.
- Ontario population estimate data were sourced from Statistics Canada. Population estimates 2001-2020: Table 1 annual population estimates by age and sex for July 1, 2001 to 2020, health regions, Ontario [unpublished data table]. Ottawa, ON: Government of Canada; 2021 [received April 22, 2021].

Data Caveats

- COVaxON and CCM are dynamic reporting systems, which allow ongoing updates to data previously entered. As a result, data extracted from COVaxON and CCM represent a snapshot at the time of extraction and may differ from previous or subsequent reports.
- The data represent vaccinations and case information reported and recorded in COVaxON or CCM. As a result, all counts may be subject to varying degrees of underreporting due to a variety of factors.
- Only cases meeting the confirmed case classification as listed in the MOH [COVID-19 case definition](#) are included.²
- Hospitalizations are defined as described in the [COVID-19 Daily Epidemiological Summary](#).³
- Vaccine effectiveness (VE) varies with age, with lower VE among older age groups. As a result the estimated impact on severe outcomes (calculated using VE for individuals 18+ years of age and older) for individuals 18-59 years of age may be an underestimate, while the estimated impact for individuals 60+ years of age may be an overestimate. Further, VE for dose 2 (i.e. complete series) and dose 3 (i.e. booster dose) may vary for certain populations, such as long-term care home residents.
- For certain populations (e.g. immunocompromised individuals) three doses are recommended to complete the primary series. Due to challenges in identifying these individuals in the COVaxON data, it was not possible to account for a three-dose primary series in the analysis, and these individuals are classified as per the definitions described in the [COVID-19 Vaccine Uptake in Ontario](#)¹ report.

- In order to estimate vaccination coverage, the definitions described in the [COVID-19 Vaccine Uptake Report](#)¹ were used. The definitions include Health Canada authorized single dose series vaccine products (i.e. Janssen) and Ontario recommendations for additional doses for individuals that received non-Health Canada authorized vaccine series. However, the Ontario-specific VE estimates used in this analysis were specific to Health Canada authorized two-dose series products. The number of individuals that received these single dose vaccine product and/or non-Health Canada authorized products is relatively small.
- Vaccination with a second booster dose is currently recommended in Ontario for limited, specific populations (i.e. long-term care home residents). Individuals vaccinated with 2 boosters, as well individuals hospitalized following 2 booster doses were included in coverage estimates for series completion and 1 booster dose and counts for hospitalizations following series completion and 1 booster dose, respectively.
- Ontario-specific VE estimates used in the analysis are for severe outcomes (i.e. hospitalization or death), however, in this analysis only the impact on hospitalizations was estimated.
- Since only the direct effects of vaccination are estimated in this analysis (e.g., indirect effects such as reduced transmission are not included) the reduction in hospitalizations are likely to be underestimated. Further, some of the infections prevented with vaccination may have resulted in severe outcomes such as hospitalization and as a result the direct estimated of the number of hospitalizations prevented is also likely to be an under-estimate.

Methods

- Methods for processing COVaxON vaccine uptake data are described in the Technical Notes of the [COVID-19 Vaccine Uptake Report](#)¹ and methods for processing the CCM case data are described in the Technical Notes of the [COVID-19 Daily Epidemiological Summary](#).³
- Analyses were limited to the Omicron-dominant time period (December 15, 2021 and later)
- The estimated number of hospitalizations averted as a direct impact of a COVID-19 booster dose was determined using methodology outlined by the United Kingdom Health Security Agency (UKHSA).⁴ The impact of COVID-19 booster doses against hospitalizations relative to a complete vaccination series was estimated using vaccination coverage (for series completion and series completion and 1 booster dose), the relative VE of dose 2 and dose 3 against hospitalizations, and observed hospitalizations. Refer to the UKHSA report for further details.
- Given the time required from vaccination to protection (i.e., to mount an immune response), the following lags were applied when estimating the direct impact:
 - A lag of 7 days (corresponding to VE estimates) was applied to estimate the impact on hospitalized cases.⁵

- The following Ontario-specific vaccine effectiveness (VE) estimates for severe outcomes (i.e. hospitalization or death) due to Omicron among individuals 18 years of age and older were used in this analysis:
 - A dose 2 (i.e. complete series) VE of 82% for at least 1 mRNA vaccine at 180-239 days. This VE estimate was applied to the total population (i.e. the same estimate was used for individuals who received their second dose less than 180 days and over 239 days ago).
 - A dose 3 (i.e. 1 booster dose) VE of 95% for any mRNA vaccine at 7 or more days following dose 3 administration.
 - Dose 2 and 3 VE estimates were used to calculate a relative VE of 72% for 1 booster dose compared to 2 doses (i.e. added benefit of a booster dose compared to a complete series).⁵

References

1. Ontario Agency for Health Protection and Promotion (Public Health Ontario). COVID-19 data and surveillance: routine surveillance report: COVID-19 vaccine uptake and program impact in Ontario: December 14, 2020 to April 17, 2021 [Internet]. Toronto, ON: Queen's Printer for Ontario; 2021 [cited 2021 Nov 23]. Available from: <https://www.publichealthontario.ca/en/data-and-analysis/infectious-disease/covid-19-data-surveillance>
2. Ontario. Ministry of Health; Ontario. Ministry of Long-Term Care. COVID-19: guidance for the health sector: case definition [Internet]. Toronto, ON: Queen's Printer for Ontario; 2021 [cited 2021 Apr 29]. Available from: https://www.health.gov.on.ca/en/pro/programs/publichealth/coronavirus/2019_guidance.aspx
3. Ontario Agency for Health Protection and Promotion (Public Health Ontario). COVID-19 data and surveillance: routine surveillance report: COVID-19 daily epidemiological summary [Internet]. Toronto, ON: Queen's Printer for Ontario; 2021 [cited 2021 Nov 23]. Available from: <https://www.publichealthontario.ca/en/data-and-analysis/infectious-disease/covid-19-data-surveillance>
4. Public Health England. COVID-19 vaccine surveillance report: week 8 [Internet]. London: Crown Copyright; 2022 [cited 2022 Mar 17]. Available from: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1057599/Vaccine_surveillance_report_-_week-8.pdf
5. Buchan SA, Chung H, Brown KA, Austin PC, Fell FB, et al. Effectiveness of COVID-19 vaccines against Omicron or Delta symptomatic infection and severe outcomes. medRxiv 21268565 [Preprint]. 2022 Jan 28 [cited 2022 Mar 17]. Available from: <https://www.medrxiv.org/content/10.1101/2021.12.30.21268565v2>

Citation

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