A comparative impact analysis of different COVID-19 vaccination strategies for older adults across two Canadian provinces

INTRODUCTION

Canada deployed a largely successful COVID-19 vaccine rollout, with some similarities to the USA, including the allocation of vaccines to provinces and states on a per-capita basis and decentralized distribution. Canada and many other countries faced shortages of mRNA vaccines early on. In response to these shortages, some jurisdictions attempted to maximize first-dose vaccine coverage by delaying second doses beyond the manufacturer’s recommended interval of three weeks for Pfizer-BIONTECH and four for Moderna. The province of Ontario formally offered, for both mRNA vaccines regardless of age, second doses approximately 11 weeks after offering first doses and permitted a maximum interval of up to 16 weeks between doses. In contrast, the province of Alberta initially permitted community-dwelling older adults aged 75 years and older to receive their second vaccine within 4–6 weeks of their first dose and the interval between doses was only extended after most older people had the opportunity to be fully vaccinated.

The aim of this analysis was to compare two different COVID-19 vaccination rollout strategies, one providing more on-time second doses and the other providing significantly delayed second doses for community-dwelling older persons during active periods of community transmission. The Canadian provinces of Ontario (“late”) and Alberta (“early”) were ideal for comparison, because of their similarly high rates of COVID-19 activity in late winter and early spring 2021.3

METHODS

We compared vaccination coverage and age-specific COVID-19 mortality rates from January–July, 2021 in people 60 years and older in two provinces with different vaccination strategies. Vaccination coverage data were obtained from the Public Health Agency of Canada, COVID-19 mortality data were obtained from provincial public health websites and age-specific mortality rates were calculated by dividing confirmed COVID-19 deaths by the mid-year population estimate from the national census.6

RESULTS

Both provinces achieved similar first-dose vaccination coverage among adults aged 60 and older by mid-April, 2021. However, second-dose coverage was approximately three times higher among people 80 years and over (Figure 1) and four-to-eight times higher among people aged 60–79 in Alberta (“early”) by mid-April compared to Ontario (“late”). We compared age-specific mortality rates for the older population before (02/Jan–17/Apr) and after (18/Apr–11/Jun) this point.

The greatest reductions in mortality were seen for the population 80 years and older, which has accounted for >60% of COVID-19 deaths in Canada.5 The average number of COVID-19 deaths per day in Alberta (“early”) decreased 75% between these two periods, compared to 55% in Ontario (“late”). Among people aged 60–79 years, the average daily number of COVID-19 deaths decreased 15% in Alberta (“early”), compared to 11% in Ontario (“late”).

Overall, COVID-19 mortality rates were approximately twice as high in Ontario (“late”) than in Alberta (“early”) between mid-April and June 2021, but after Ontario began offering second doses to community-dwelling adults 80 years and older on May 31, 2021, complete vaccination rates equalized and the discrepancy in mortality declined (Figure 1). We estimate that if Ontario achieved the same proportionate reduction in age-specific mortality as Alberta reported between April–June 2021 and the preceding months, there could have been up to 210 fewer deaths among Ontarians 80 years and older.

DISCUSSION

Alberta’s older population appears to have benefited from earlier and complete vaccination against COVID-19
instead of prolonging the interval between doses to maximize limited early supplies.

Although increasing first-dose vaccine coverage by prolonging the interval between doses may be an effective strategy for protecting younger populations when vaccine supplies are limited, emerging data indicate that older people have a reduced immune response to a single dose of mRNA vaccine compared to younger people. Moreover, the efficacy of one dose of an mRNA vaccine for preventing hospitalization due to COVID-19 is lower among people 75 years and older, even compared to those 65–74 years, although full vaccination seems to offer similar protection. We estimated that more on-time second-doses could have prevented up to 210 deaths in older Ontarians.

Our analysis has several limitations. It was not possible to determine the average interval between first- and second-dose vaccination. Inaccuracies or delays in the reporting of COVID-19 deaths could result in the under-ascertainment of cases. We did not account for differences in public health policy or hospital capacity; however, Ontario had more stringent public health measures than Alberta during the periods analyzed.

In conclusion, prolonging the interval between first and second doses of COVID-19 mRNA vaccines to extend limited vaccine supplies during an active surge in community transmission may adversely impact older populations, which remain at the greatest risk of hospitalization and death from COVID-19. The findings may extend to the rollout of booster vaccines for older people in response to waning immunity and novel COVID-19 variants, though further study is needed.

CONFLICT OF INTEREST
The authors declare that there is no conflict of interest.

AUTHOR CONTRIBUTIONS
Emily Boucher analyzed mortality data and drafted the article. Natalie Iciaszczyk analyzed the vaccination data. Cameron Feil and Samir Sinha contributed substantially to the interpretation of results. Samir Sinha designed and supervised the project. All authors contributed to the preparation of the final manuscript and read and approved the final version.

SPONSOR’S ROLE
The study was not sponsored.
Correspondence

Dr. Samir Sinha, Director of Geriatrics, Sinai Health and University Health Network, 475-600 University Avenue, Toronto, ON, M5G1X5, Canada.
Email: samir.sinha@sinaihealth.ca

REFERENCES

1. National Advisory Committee on Immunization (NACI). Recommendations on the use of COVID-19 vaccine(s). 2021. Available from: https://www.canada.ca/en/public-health/services/immunization/national-advisory-committee-onimmunization-naci/recommendations-usecovid-19-vaccines/december-12-2020.html. Accessed September 21, 2021.

2. Anticipated schedule for second doses of COVID-19 vaccines. 2021. Government of Ontario (online). Available at https://news.ontario.ca/en/backgrounder/1000220/anticipated-schedule-for-second-doses-of-covid-19-vaccines. Accessed July 31, 2021.

3. Vaccinating more Albertans faster. 2021. Government of Alberta (online). Available at https://www.alberta.ca/release.cfm?id=77647C3873F1B-F805-C364-A64CE3691D9D6F15. Accessed July 05, 2021.

4. COVID-19 Daily Epidemiologic Summary. 2021. Public Health Ontario (online). Available from: https://www.publichealthontario.ca/en/data-and-analysis/infectious-disease/covid-19-data-surveillance. Accessed July 30, 2021.

5. COVID-19 Alberta Statistics. 2021. Government of Alberta (online). Available from: https://www.alberta.ca/stats/covid-19-alberta-statistics.htm#data-export. Accessed July 30, 2021.

6. Population Estimates on July 1st, by age and sex. 2020. Statistics Canada (online). Available from: https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=1710000501. Accessed July 05, 2021.

7. Romero-Brufau S, Chopra A, Ryu AJ, et al. Public health impact of delaying second dose of BNT162b2 or mRNA-1273 covid-19 vaccine: simulation agent-based modeling study. BMJ. 2021;373:n1087. doi:10.1136/bmj.n1087

8. Collier DA, Ferreira IA, Kotagiri P, et al. Age-related immune response heterogeneity to SARS-CoV-2 vaccine BNT162b2. Nature. 2021;596:417-422. doi:10.1038/s41586-021-03739-1

9. Moline HL, Whitaker M, Deng L, et al. Effectiveness of COVID-19 vaccines in preventing hospitalization among adults aged ≥65 years – COVID-NET, 13 states, February—April 2021. MMWR Morb Mortal Wkly Rep. 2021;70:1088-1093. 10.15585/mmwr.mm7032e3

10. Paisley Sim: COVID-19 Policy Stringency across Province 2021. Sim, P (online). Available from: https://www.mcgill.ca/maxbellschool/article/articles-max-policy/covid-19-policy-stringency-across-provinces. Accessed June 5, 2021.