

EVIDENCE BRIEF

(ARCHIVED) Risk of COVID-19 Transmission
from Vaccinated Cases

Published: June 2021

Archived: February 2022

ARCHIVED DOCUMENT

This archived content is being made available for historical research and reference purposes only. PHO is no longer updating this content and it may not reflect current guidance.

Key Messages

- Lower viral loads and reduced duration of infectiousness are observed in vaccinated individuals infected with SARS-CoV-2.
- Limited evidence suggests a reduced risk of transmission to household members from infected vaccinated health care workers (HCW), including infection from variants of concern (VOC) B.1.1.7 and B.1.351.
- Most jurisdictions have not changed case isolation requirements for fully vaccinated individuals who become infected.

Issue and Research Question

While vaccination has substantially reduced the risk of infection among vaccinated individuals, breakthrough cases do occur.¹ Infections in vaccinated individuals are less severe and more likely to be asymptomatic, but the risk of onward transmission of infection from fully vaccinated individuals² is unclear. This Evidence Brief summarizes evidence on risk of transmission from vaccinated cases of COVID-19, as well as jurisdictional guidance on the management of fully vaccinated cases.

Methods

This evidence brief contains two sources of published evidence: a grey and peer-reviewed rapid literature search, and review of public health guidance documents from selected public health organizations and jurisdictions. Grey and published literature records were hand-searched up to May 26, 2021, with article selection criteria related to indirect evidence of level of infectiousness by cases' viral load and duration of detectable viral load, and direct evidence of secondary transmission from cases. Public health guidance and recommendations on management of fully vaccinated individuals from the following public health organizations and jurisdictions was reviewed between May 11th to 26th, 2021: the United States Centre for Disease Control (CDC), the European Center for Disease Control and Prevention

(ECDC), England, Scotland, Ireland, Germany, Australia, Israel, and select Canadian provinces (Alberta, British Columbia, Manitoba, and Quebec).³⁻¹⁴ Public health guidance on management of fully vaccinated contacts is out of scope for this product.

Main Findings

Reduced Viral Load in Vaccinated Cases

Increased viral load levels are associated with increased risk of transmission. In a cohort study from Spain¹⁵ including 282 clusters, the viral load of index cases was a leading driver of SARS-CoV-2 transmission.

Studies have shown that COVID-19 cases among partial and fully vaccinated individuals have lower viral loads (based on higher cycle threshold (Ct) values¹⁶) than unvaccinated cases, including in elderly nursing home residents.

- In the US¹⁷, residents of a nursing home who received a single dose Pfizer vaccine within the previous 3 weeks and developed asymptomatic COVID-19 infection had significantly lower viral load (higher Ct values) than those who were unvaccinated.
- A report of a nursing home outbreak associated with B.1.351 lineage in France¹⁸ found all unvaccinated residents (5/5) became infected whereas only 50% (13/26) of fully vaccinated residents were infected. The mean Ct value was significantly lower in non-vaccinated residents (mean Ct: 15, range 12-17) than in vaccinated residents (mean Ct: 21, range: 13-32), $p < 0.05$.
- A study in Israel¹⁹ compared Ct values in the first 11 days post first dose vaccine, when no immune protection is expected, to Ct values 12-37 days after first dose. Mean Ct values were significantly higher for infections in the latter time period, equating to approximately 2.8-4.5 fold reduction in viral load in individual with one dose protection. This association remained when restricting analysis to symptomatic cases adjusting for age and sex.

Potential Shortened Duration of Infectiousness in Vaccinated Individuals

There is some limited evidence for a shortened duration of viral detection in vaccinated individuals.

- An Italian study²⁰ on SARS-CoV-2 infection conducted to estimate asymptomatic infections among vaccinated and unvaccinated hospital HCW involved daily collection of 500 nasopharyngeal swab specimens of HCWs and hospitalized patients. From January to March 2021, seven HCWs who had received Pfizer vaccine tested positive for B.1.1.7 lineage; six of these cases had both doses of the vaccine (3 within 8 days of second dose and 3 after more than 3 weeks) while one had only received the first dose. All cases were detected by routine asymptomatic surveillance testing and remained asymptomatic. Three of the cases were negative on re-test the day after their positive result, and the other four cases re-tested negative 10 days after.
- In a preprint article from the UK²¹, a single-blind multicentre randomised phase II/III Astra Zeneca (AZ) trial examined its efficacy against COVID-19 infections (mainly symptomatic) with B.1.1.7 lineage in comparison to non-B.1.17 lineages. AZ vaccine recipients had a significantly

lower viral load as represented by minimum Ct values. Vaccination reduced the median length of time with positive virus detection by one week (median 1.0 week interquartile range (IQR): 1.0 -2.0 AZ vs. median 2.0 weeks IQR: 1.0-3.0 Control).

Lower Risk of Secondary Transmission from Vaccinated Cases

There is limited evidence for the risk of secondary transmission from vaccinated cases due to small numbers of breakthrough cases, and these studies have only assessed household transmission.

- A preprint study from the UK²² examined documented COVID-19 cases and hospitalizations in unvaccinated household members of vaccinated and unvaccinated HCWs from December 8, 2020 to March 3, 2021. The study included 194,362 household members and 144,525 HCW (78.3% were 14 days or more post first dose AZ or Pfizer, with 25.1% fully vaccinated). There were 3,123 cases with 175 hospitalizations among unvaccinated household members. Adjusted hazard ratio for infection in individuals sharing households with vaccinated HCWs was 0.70 (95%CI: 0.62-0.78) compared to those sharing households with unvaccinated HCWs. There was a 55% risk reduction for household members becoming cases from fully vaccinated HCWs compared to unvaccinated ones, adjusted hazard ratio 0.46 (95%CI: 0.30-0.70). It is not clear from the study if the risk reduction in unvaccinated household members was due to the HCWs not being infected in the first place or them being infected but not transmitting to their household members.
- Another preprint study in the UK²³ looked nation-wide at a cross-section of mostly partially vaccinated individuals (93% received one dose of AZ or Pfizer-BioNTech) from January 4, 2021 to February 28, 2021. This study examined 365,447 households with at least one infected person, found that household contacts of infected and vaccinated individuals (up to 60 days after the first dose) were less likely than household contacts of unvaccinated cases to become a case. Household transmission was assessed for index cases vaccinated 21 or more days prior compared to unvaccinated index cases, with adjusted odds ratios for AZ 0.55 (95%CI: 0.46,0.67) and Pfizer 0.57 (95%CI: 0.43, 0.63). This suggested the likelihood of household transmission was approximately 40-50% lower for households in which the index cases were partially vaccinated 21 days or more prior to testing positive when compared to index cases who are not vaccinated.

Jurisdictional Scan for Modified Case Management of Breakthrough Cases

Most of the jurisdictions reviewed (US²⁴, ECDC²⁵, UK²⁶, Australia²⁷, other Canadian jurisdictions¹¹⁻¹⁴) have not modified their isolation recommendations for fully vaccinated cases. No change in the management of contacts of these breakthrough cases has also been noted.

The ECDC's interim guidance on the benefits of full vaccination against COVID-19 for transmission²⁵ (April 21, 2021) has taken a risk assessment approach through synthesizing the evidence to date. They concluded that the likelihood that a fully vaccinated person will transmit SARS-CoV-2 to a unvaccinated individual is very low to low and that the impact of the unvaccinated contact developing severe disease if transmission has occurred is low to high, depending on their age and underlying medical conditions. Other modulating factors may affect the risk of transmission, such as presence of VOC, the nature and duration of contact, the use of prevention measures, the type of vaccine received, and the length of time since vaccination (as duration of immunity following vaccination is not known to date). The ECDC also concluded that the risk of infection and onward transmission of SARS-CoV-2 in fully vaccinated individuals should not be considered in isolation but should always be assessed in the broader epidemiological context of SARS-CoV-2.

Germany is the only jurisdiction identified with updated management guidance for fully vaccinated cases⁸ and has reduced their isolation time to 5 days if a negative test result is subsequently obtained and the case remains asymptomatic. Otherwise, if the PCR follow-up test result remained positive or if the individual became symptomatic, the routine isolation requirements apply.

Discussion and Conclusions

There is emerging evidence that the risk of secondary transmission from vaccinated individuals who become cases is likely reduced compared to unvaccinated cases, as a result of potential lower viral load and shortened period of virus detection. Most of the evidence was found for jurisdictions where B.1.1.7 was a dominant variant, although there is limited evidence for other VOC. Most jurisdictions have maintained public health isolation requirements for vaccinated cases, likely due to the uncertainty around the vaccine effectiveness in sub-populations (e.g., elderly, immune suppressed) and against the emerging VOC with immune escape potential.

Knowledge Gaps and Limitations

There is still relatively limited evidence to inform secondary transmission risk from partially and fully vaccinated cases, as well as the factors that may increase that risk. There is also limited evidence for individual-level factors that may reduce a person's protection from vaccination (e.g., age, co-morbid conditions), and the differential risk for secondary transmission from an asymptomatic vs. symptomatic case. Additionally, emergence of VOC with vaccine escape potential may increase the risk of secondary transmission even if the index case remains asymptomatic. There is limited evidence regarding secondary transmission from vaccinated cases to individuals outside of the household setting, such as within health care settings and congregate care settings, where there is a lower risk tolerance for any transmission to vulnerable patients/residents from vaccinated cases.

Implications for Practice

Currently in Ontario, most fully vaccinated individuals with high risk exposures are advised to be tested, but in general, do not have to quarantine if they remain asymptomatic after exposure.²⁸ This guidance is based on current evidence of vaccine effectiveness and lower risk of secondary transmission if an exposed vaccinated individual was to become infected. However, all confirmed COVID-19 cases, regardless of vaccination status, must isolate for at least 10 days from symptom onset (or 10 days from positive test collection date if they never had symptoms), provided that the individual is afebrile (without the use of fever-reducing medications) and symptoms are improving for at least 24 hours, unless they have severe disease or severe immune compromise.²⁸ Therefore, current guidance does not account for the potential for lower risk of secondary transmission from vaccinated cases (particularly from asymptomatic cases), the potential for shorter duration of infectiousness in vaccinated cases, or the implication of a negative test after a positive result in a vaccinated case.

The current Management of Cases and Contacts of COVID-19 in Ontario Version 12.0³⁰ allows for local public health units to discontinue case and contact management if they assess a low likelihood of infectiousness from a positive result (e.g., in an asymptomatic individual with low pre-test probability, regardless of vaccination status, and a high Ct value with repeat negative test result). Vaccination status may be another factor in assessing a "low pre-test probability" for such cases, given the lower likelihood of infection despite exposure with vaccination, and may support discontinuation of case and contact management.

Emerging evidence may also inform public health practice on the management of vaccinated individuals who test positive, and then subsequently test negative prior to the end of their usual 10-day isolation date, given lower and shortened duration of infectiousness reported in the literature. Two negative tests collected 24 hours apart after a positive test would meet the current Ontario 'test-based clearance' criteria²⁹ for discontinuing isolation for cases regardless of vaccination status; however, this requirement may be onerous for the individual as it involves testing the person twice at least 24 hours apart. Early discontinuation of case isolation after a single negative test may be supported for persistently asymptomatic vaccinated cases based on Germany's updated guidance⁸; however, preferred timing of follow-up testing and duration of isolation to assess for development of symptoms is unclear. Finally, public health unit discretion for case management is necessary in considering the individual case context.

Considerations for early discontinuation of isolation of cases who are fully vaccinated will also imply a similar approach to their contacts (who are currently not exempt from quarantine as per the provincial guidance for fully vaccinated individuals²). However, there is insufficient evidence at this time to inform a change in isolation requirements for these contacts.

References

1. Ontario Agency for Health Protection and Promotion (Public Health Ontario). Confirmed cases of COVID-19 following vaccination in Ontario: December 14, 2020 to May 15, 2021 [Internet]. Toronto, ON: Queen's Printer for Ontario; 2021 [cited 2021 Jun 01]. Available from: <https://www.publichealthontario.ca/-/media/documents/ncov/epi/covid-19-epi-confirmed-cases-post-vaccination.pdf?la=en>
2. Ontario. Ministry of Health. COVID-19 fully vaccinated individuals: case, contact and outbreak management interim guidance [Internet]. Version 1.0. Toronto, ON: Queen's Printer for Ontario; 2021 [modified 2021 May 06; cited 2021 May 26]. Available from: https://www.health.gov.on.ca/en/pro/programs/publichealth/coronavirus/docs/contact_mngmt/COVID-19_fully_vaccinated_interim_guidance.pdf
3. Centers for Disease Control and Prevention. COVID-19 [Internet]. Atlanta, GA: Centers for Disease Control and Prevention; 2021 [cited 2021 May 26]. Available from: <https://www.cdc.gov/coronavirus/2019-ncov/index.html>
4. European Center for Disease Control and Prevention. COVID-19 [Internet]. Stockholm: European Center for Disease Control and Prevention; 2021 [cited 2021 May 26]. Available from: <https://www.ecdc.europa.eu/en/covid-19>
5. Public Health England. Coronavirus (COVID-19) [Internet]. London: Crown Copyright; 2021 [cited 2021 May 26]. Available from: <https://www.gov.uk/coronavirus>
6. Scottish Government. Coronavirus in Scotland [Internet]. Edinburgh: Crown Copyright; 2021 [cited 2021 May 26]. Available from: <https://www.gov.scot/coronavirus-covid-19/>
7. Government of Ireland, Department of Health; Department of the Taoiseach. COVID-19 resilience and recovery: the path ahead [Internet]. Dublin: Government of Ireland; 2021 [modified 2021 Jun 04; cited 2021 May 26]. Available from: <https://www.gov.ie/en/campaigns/c36c85-covid-19-coronavirus/>
8. Robert Koch Institute. COVID-19: release criteria from isolation [Internet]. Berlin: Robert Koch Institute; 2021 [modified 2021 May 18; cited 2021 May 26]. Available from: https://www.rki.de/DE/Content/InfAZ/N/Neuartiges_Coronavirus/Entlassmanagement.html
9. Australian Government, Department of Health. Coronavirus (COVID-19) health alert [Internet]. Canberra: Commonwealth of Australia; 2021 [modified 2021 Jun 07; cited 2021 May 26]. Available from: <https://www.health.gov.au/news/health-alerts/novel-coronavirus-2019-ncov-health-alert>
10. Israel. Ministry of Health. Coronavirus [Internet]. Jerusalem: Government of Israel; 2021 [cited 2021 May 26]. Available from: <https://www.gov.il/en/departments/topics/corona-main-sub>
11. Alberta Health Services, Scientific Advisory Group. COVID-19 Scientific Advisory Group evidence summary and recommendations [Internet]. Edmonton, AB: Alberta Health Services; 2021 [modified 2021 Mar 23; cited 2021 May 26]. Available from: <https://www.albertahealthservices.ca/assets/info/ppih/if-ppih-covid-19-sag-post-vaccine-transmission-rapid-review.pdf>

12. BC Centre for Disease Control. Interim guidance: public health management of cases and contacts associated with novel coronavirus (COVID-19) in the community [Internet]. Vancouver, BC: Provincial Health Services Authority; 2021 [modified 2021 Apr 15; cited 2021 May 26]. Available from: http://www.bccdc.ca/resource-gallery/Documents/Guidelines%20and%20Forms/Guidelines%20and%20Manuals/Epid/CD%20Manual/Chapter%201%20-%20CDC/2019-nCoV-Interim_Guidelines.pdf
13. Government of Manitoba. Interim guidance public health measures: managing novel coronavirus (COVID-19) cases and contacts in community [Internet]. Winnipeg, MB: Queen's Printer for Manitoba; 2021 [modified 2021 Jun 04; cited 2021 May 26]. Available from: https://manitoba.ca/asset_library/en/coronavirus/interim_guidance.pdf
14. Institut National de Santé Publique du Québec. COVID-19: mesures pour la gestion des cas et des contacts dans la communauté: recommandations intérimaires [Internet]. Québec, QC: Gouvernement du Québec; 2021 [modified 2021 May 14; cited 2021 May 26]. Available from: <https://www.inspq.qc.ca/sites/default/files/publications/2902-mesures-gestion-cas-contacts-communaute.pdf>
15. Marks M, Millat-Martinez P, Ouchi D, Roberts C, Alemany A, Corbacho-Monne M, et al. Transmission of COVID-19 in 282 clusters in Catalonia, Spain: a cohort study. *Lancet Infect Dis*. 2021;21(5):629-36. Available from: [https://doi.org/10.1016/S1473-3099\(20\)30985-3](https://doi.org/10.1016/S1473-3099(20)30985-3)
16. Ontario Agency for Health Protection and Promotion (Public Health Ontario). Focus on: an overview of cycle threshold values and their role in SARS-CoV-2 real-time PCR test interpretation [Internet]. Toronto, ON: Queen's Printer for Ontario; 2020 [cited 2021 Jun 01]. Available from: <https://www.publichealthontario.ca/-/media/documents/ncov/main/2020/09/cycle-threshold-values-sars-cov2-pcr.pdf?la=en>
17. McEllistrem MC, Clancy CJ, Buehrle DJ, Lucas A, Decker BK. Single dose of a mRNA SARS-CoV-2 vaccine is associated with lower nasopharyngeal viral load among nursing home residents with asymptomatic COVID-19. *Clin Infect Dis*. 2021 Mar 26 [Epub ahead of print]. Available from: <https://doi.org/10.1093/cid/ciab263>
18. Bailly B, Guilpain L, Bouiller K, Chirouze C, N'Debi M, Soulier A, et al. BNT162b2 mRNA vaccination did not prevent an outbreak of SARS COV-2 variant 501Y.V2 in an elderly nursing home but reduced transmission and disease severity. *Clin Infect Dis*. 2021 May 16 [Epub ahead of print]. Available from: <https://doi.org/10.1093/cid/ciab446>
19. Levine-Tiefenbrun M, Yelin, I, Katz R, Herzel E, Golan Z, Schreiber L, et al. Initial report of decreased SARS-CoV-2 viral load after inoculation with the BNT162b2 vaccine. *Nat Med*. 2021;27(5):790-2. Available from: <https://doi.org/10.1038/s41591-021-01316-7>
20. Damiani V, Mandatori D, De Fabritiis S, Bibbo S, Ferrante R, Di Guiseppe F, et al. SARS-CoV-2 infection in asymptomatic vaccinated health care workers. *Infect Control Hosp Epidemiol*. 2021 May 10 [Epub ahead of print]. Available from: <https://doi.org/10.1017/ice.2021.224>
21. Emary KRW, Golubchik T, Aley PK, Ariani CV, Angus B, Bibi S, et al. Efficacy of ChAdOx1 nCoV-19 (AZD1222) vaccine against SARS-CoV-2 VOC 202012/01(B.1.1.7). SSRN 3779160 [Preprint]. 2021 Feb 04 [cited 2021 Jun 02]. Available from: <https://doi.org/10.2139/ssrn.3779160>

22. Shah ASV, Gribben C, Bishop J, Hanlon P, Caldwell D, Wood R, et al. Effect of vaccination on transmission of COVID-19: an observational study in health care workers and their households. medRxiv 21253275 [Preprint]. 2021 Mar 21 [2021 Jun 02]. Available from: <https://doi.org/10.1101/2021.03.11.21253275>
23. Harris RJ, Hall JA, Zaidi A, Andrews NJ, Dunbar JK, Dabrera G. Impact of vaccination on household transmission of SARS-COV-2 in England [Internet]. London: Public Health England; 2021 [cited 2021 May 28]. Available from: <https://khub.net/documents/135939561/390853656/Impact+of+vaccination+on+household+transmission+of+SARS-COV-2+in+England.pdf/35bf4bb1-6ade-d3eb-a39e-9c9b25a8122a?t=1619601878136>
24. Centers for Disease Control and Prevention. COVID-19: interim public health recommendations for fully vaccinated people [Internet]. Atlanta, GA: Centers for Disease Control and Prevention; 2021 [cited 2021 May 26]. Available from: <https://www.cdc.gov/coronavirus/2019-ncov/vaccines/fully-vaccinated-guidance.html#>
25. European Centre for Diseases Prevention and Control. Technical report: interim guidance on the benefits of full vaccination against COVID-19 for transmission and implications for non-pharmaceutical interventions [Internet]. Stockholm: European Center for Disease Control and Prevention; 2021 [modified 2021 Apr 21; cited 2021 May 26]. Available from: <https://www.ecdc.europa.eu/sites/default/files/documents/Interim-guidance-benefits-of-full-vaccination-against-COVID-19-for-transmission-and-implications-for-non-pharmaceutical-interventions.pdf>
26. Public Health England. Stay at home: guidance for households with possible or confirmed coronavirus (COVID-19) infection [Internet]. London: Crown Copyright; 2021 [modified 2021 May 19; cited 2021 May 26]. Available from: <https://www.gov.uk/government/publications/covid-19-stay-at-home-guidance/stay-at-home-guidance-for-households-with-possible-coronavirus-covid-19-infection>
27. Healthdirect Australia. COVID-19 isolation and quarantine [Internet]. Canberra: Australian Government; 2021 [cited 2021 May 26]. Available from: <https://www.healthdirect.gov.au/coronavirus-covid-19-self-isolation-faqs#criteria>
28. Government of Ontario. COVID-19 fully vaccinated individuals: case, contact and outbreak management interim guidance [Internet]. Toronto, ON: Queen's Printer for Ontario; 2021 [cited 2021 May 30]. Available from: https://www.health.gov.on.ca/en/pro/programs/publichealth/coronavirus/docs/contact_mngmt/COVID-19_fully_vaccinated_interim_guidance.pdf
29. Ontario. Ministry of Health. COVID-19 quick reference public health guidance on testing and clearance [Internet]. Version 14.0. Toronto, ON: Queen's Printer for Ontario; 2021 [modified 2021 May 21; cited 2021 May 30]. Available from: https://www.health.gov.on.ca/en/pro/programs/publichealth/coronavirus/docs/2019_testing_clearing_cases_guidance.pdf
30. Ontario. Ministry of Health. Management of cases and contacts of COVID-19 in Ontario [Internet]. Version 12.0. Toronto, ON: Queen's Printer for Ontario; 2021 [modified 2021 May 06; cited 2021 May 30]. Available from: https://www.health.gov.on.ca/en/pro/programs/publichealth/coronavirus/docs/contact_mngmt/management_cases_contacts.pdf

Citation

Ontario Agency for Health Protection and Promotion (Public Health Ontario). Risk of COVID-19 transmission from vaccinated cases. Toronto, ON: Queen's Printer for Ontario; 2021.

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.

©Queen's Printer for Ontario, 2021

Ontario 