

FOCUS ON

Mitigating Risk of Breakthrough Transmission from Delta Variant

August 2021

Key highlights

- Vaccination is highly effective for preventing SARS-CoV-2 infection and serious outcomes when infection occurs, including against the Delta variant.
- There is emerging evidence that Delta is more likely to cause breakthrough infections, and when breakthrough cases occur, they have similar levels of infectiousness as unvaccinated cases.
- There is still limited epidemiological evidence on the risk of secondary transmission from breakthrough Delta cases, as existing evidence has been primarily based on Alpha.
- Fully vaccinated individuals must remain vigilant and follow the necessary public health precautions if they are exposed to a case (i.e., seek testing following an exposure and/or if experiencing even mild symptoms) in order to reduce the risk of transmission.
- Public health messaging should continue to reinforce existing public health measures (i.e., vaccination, physical distancing, wearing a mask) and incorporate emerging information on the risks of Delta.

Introduction

Vaccines have been highly effective for preventing SARS-CoV-2 infection and serious outcomes when infection occurs, including against the Delta variant of concern (VOC).¹ Unvaccinated cases still account for the majority of cases, however breakthrough infections (defined as infection occurring more than two weeks after final vaccine dose) do occur.^{2,3} There is emerging data that the level of infectiousness of Delta breakthrough cases are similar to that of unvaccinated cases, which has implications for Ontario's current public health measures which are less restrictive for fully vaccinated individuals. Furthermore, it is possible that fully vaccinated individuals may be less likely to recognize and/or report symptoms particularly if they are mild.

This Focus On will review the evidence for the infectiousness of breakthrough cases infected with the Delta variant and considerations for enhancing case and contact management for fully vaccinated cases to prevent secondary transmission.

Methods

A comprehensive literature search, developed and peer-reviewed by members of the PHO Library Services team, was run in Ovid MEDLINE to retrieve articles containing at least one search term related to COVID-19 and one search term related to virus variants in the title, abstract, subject heading, or keyword heading fields. This search strategy was subsequently programmed to conduct daily searches based on the search criteria, and all relevant articles including grey literature were selected and saved to a collection of citations on the topic. Additional results from email alerts and hand searching of key scientific journals, grey literature sources, and preprint servers were also included. This collection of citations formed the evidence base for this Focus On review, with a minimum of two reviewers screening the full text of each item in the collection before it was included in the final review.

Background

Ontario context

Currently in Ontario, public health case and contact management allows for many asymptomatic fully vaccinated individuals who are high risk contacts to be exempt from quarantine (i.e., self-isolation), but they are recommended to be tested immediately, self-monitor for symptoms and to wear a mask when outside of the home during the 10-day self-monitoring period.⁴ This does not apply to those who are immunocompromised, hospitalized patients or long-term care facility residents. Additionally, there is allowance for public health units (PHUs) to still require quarantine of asymptomatic fully vaccinated high risk contacts if there is evidence or suspicion of a variant with escape potential, other evidence of breakthrough infections occurring, or in outbreak situations.

PIDAC's Interim Guidance for Fully Vaccinated Health Care Providers, updated in June 2021, included stricter recommendations for work exclusion for fully vaccinated health care providers with the highest-risk exposures (e.g., being a household contact of a case), or exposures associated with a source known to be infected with a VOC associated with reduced vaccine efficacy.⁵ The PIDAC recommendation applies to exposed health care workers working in acute care facilities, who are more likely to interact with vulnerable populations.

Findings

Emerging Evidence on Delta

There is a significant reduction in the risk of infection with Delta when fully vaccinated, a significant reduction in both symptomatic infection and severe outcomes, and there is some evidence that fully vaccinated cases have a significantly faster decline in viral loads (indicating shorter duration of infectiousness).⁶

However, emerging evidence on Delta indicates this variant is more highly transmissible, more virulent, cases are more likely to be highly infectious, is more likely to cause breakthrough infections, and when breakthrough cases occur they have similar levels of infectiousness as unvaccinated cases. There is evidence that fully vaccinated individuals with the Delta variant can transmit the infection to others, although it appears their period of infectiousness is shorter.³

- Recent Ontario estimates of vaccine effectiveness against Delta found 85% (95%CI: 59, 94) protection for symptomatic infection and fully vaccinated with Pfizer-BioNTech.⁷

- The recently published United States (US) Centers for Disease Control and Prevention (CDC) Morbidity and Mortality Weekly Report⁸ looked at new SARS-CoV-2 cases and hospitalizations among adults in the state of New York, by vaccination status and corresponding vaccine effectiveness (VE) and found:
 - The currently US-authorized vaccines are highly effective against hospitalizations, but appears to be less effective against new infections during the time period where Delta has become the dominant strain in the US and public health measures (i.e., masking and physical distancing) have been relaxed.
 - Overall age-adjusted VE against new SARS-CoV-2 cases for all adults declined from 91.7% to 79.8% during May 3 – July 25, 2021. Over the same period, the VE against hospitalization for fully vaccinated New York residents remained relatively stable (VE >90%).
- The Round 13 (May to July 2021) data from England’s Real-time Assessment of Community Transmission-1 (REACT-1) study⁹, where there was 100% Delta variant infection, found:
 - Exponential increasing trend in prevalence of SARS-CoV-2 infections with sustained growth was observed during the study period, compared to prior periods, with a reproductive number (R) of 1.28 (95% CI: 1.24, 1.31), mainly driven by younger age groups.
 - Swab positivity was three-fold higher among unvaccinated (1.21%) compared to fully vaccinated (0.4%). Vaccine effectiveness (VE) for all swab positives was 49% (22%, 67%), and for symptomatic infections was 59% (23%, 78%). When using linked data on vaccination status, VE increased to 62% (38%, 77%), but is subject to selection bias of patients consenting to linkage.
 - 44% of infections occurred among fully vaccinated individuals, and positivity was 3.84% (2.81%, 5.21%) for fully vaccinated individuals with known contact with a COVID-19 case.
 - Median cycle threshold (Ct) value for vaccinated participants was 27.6 (25.5, 29.7) versus in unvaccinated was 23.1 (20.3, 25.8). While higher in vaccinated participants, the majority of infections in vaccinated individuals had Ct <30, where there is a greater likelihood of detecting viable virus and associated infectiousness.
 - It is worth noting that breakthrough cases are defined in this study as being double vaccinated regardless of the time interval between vaccine administration and infection. This differs from the provincial definition which specifies a breakthrough infection as one that occurs more than two weeks after the final vaccine dose.
- Public Health England’s Technical Briefing from August 6, 2021¹⁰, reported:
 - Secondary attack rates for Delta cases were 10.4% (10.1%, 10.7%) for household contacts and 6.2% (5.8%, 6.7%) for non-household contacts (similar to rates for Alpha).
 - Median Ct value for Delta cases was 17.8 (unvaccinated) and 18.0 (fully vaccinated), indicating similar level of infectiousness when breakthrough cases occur, even though risk of becoming a case is significantly reduced when fully vaccinated. This analysis did not take into account age distribution of cases or test-seeking behaviours.

- A pre-print from the United States in a county with high vaccination coverage and frequent testing compared to other parts of the country found no significant difference in Ct values between fully vaccinated and unvaccinated individuals. One-third (33%) of fully vaccinated cases had extremely low Ct values <20. Where sequencing was available, 88% of specimens were Delta.¹¹
- A pre-print from Singapore of a cohort of 201 Delta cases found fully vaccinated cases were older (corresponding to the age group prioritized for vaccination), and were more likely to be asymptomatic, when symptomatic had fewer symptoms, and none of the 71 fully vaccinated cases required ICU admission (vs 5.4% among unvaccinated). Median initial Ct value did not differ between unvaccinated (18.8, IQR: 14.9-22.7) versus vaccinated (19.2, IQR: 15.2-22.2). However, fully vaccinated cases had a faster increase in Ct value over time compared to unvaccinated.¹²
- A pre-print from Texas of 4,920 cases from March 15 to July 24, 2021, with 22.7% of cases having Delta variant. Delta cases had significantly lower median Ct value compared to other variants, and a higher proportion of fully vaccinated cases (17.4% versus 5.8% for other variants). There was no significant difference between median Ct values for Delta cases who were fully vaccinated versus unvaccinated.¹³
- A report of an outbreak with 469 cases in a highly vaccinated county in Massachusetts found that 74% of cases occurred among fully vaccinated individuals. Four out of five hospitalizations occurred in fully vaccinated individuals, and no deaths were reported for the outbreak. Ct values were similar between fully vaccinated and unvaccinated cases. Where testing was available, Delta accounted for 90% of the cases.¹⁴
- A pre-print from Ontario found the adjusted elevation of risk associated with Delta variant compared to non-variant of concern infection was 108% (80%-138%) for hospitalization, 234% (164%-331%) for ICU admission and 132% (47%-230%) for death after adjusting for age, sex, vaccination status, comorbidities, health unit, and temporal trend.¹⁵

Infectiousness of Breakthrough Cases

Public Health Ontario's previous summary of epidemiological evidence on the infectiousness of breakthrough cases was primarily based on evidence prior to the emergence of Delta.¹⁶

More recent epidemiological evidence on the secondary attack rate of breakthrough cases is still primarily based on infections with Alpha. One recent study from Israel followed breakthrough cases among 39 healthcare workers (85% Alpha) that did not lead to any secondary infections, despite most cases having Ct values that suggested they had been infectious at some point, including among asymptomatic infections.¹⁷

Implications for Public Health Case and Contact

Management

Although evidence on vaccine effectiveness and epidemiological data of case counts show a high degree of protection following mass vaccination campaigns against SARS-CoV-2 infection,² the emergence of VOCs (particularly those capable of vaccine escape) has prompted further consideration for the appropriate management of fully vaccinated individuals with high risk exposures. Furthermore, the emerging evidence demonstrating similar levels of infectiousness from fully vaccinated Delta cases as in

unvaccinated cases, suggest a need for a strengthened approach to case and contact management for fully vaccinated high risk contacts, to prevent the risk of transmission from breakthrough cases.

Contact management approaches for fully vaccinated individuals infected with Delta may result in secondary transmissions if the case is dismissive of their risk of becoming a case, ignores mild symptoms that may indicate infection, or is unaware that they may be asymptotically infectious to others and does not seek asymptomatic testing in their post-exposure period and does not take precautions to prevent spreading to others. Fully vaccinated individuals need to be aware of the differences observed with Delta infections, and that there are still necessary precautions they need to take if they have been exposed to someone with COVID-19. While full quarantine may not be required due to their much lower risk of becoming infected when fully vaccinated, contact follow-up of fully vaccinated individuals as high risk contacts is necessary to ensure risks of secondary transmission are mitigated.

Public communication should incorporate information on the risks of Delta while maintaining public confidence in vaccination, and reaffirming the significant risk reduction from becoming infected and from having a severe outcome if infected when fully vaccinated. Additionally, public messaging should aim to maintain and reinforce existing public health measures including vaccination and non-pharmaceutical interventions (e.g., hand hygiene, wearing a mask, physical distancing) that remain crucial to mitigating the risks of transmission from Delta on a societal level.

Conclusion

Emerging evidence on the Delta variant shows that while fully vaccinated individuals are at significantly reduced risk of becoming infected, they may be just as infectious to others if they become infected, even when asymptomatic, as someone who is not fully vaccinated. There is still limited epidemiological evidence on the risk of secondary transmission from breakthrough cases infected with the Delta variant, and current evidence is primarily based on the Alpha variant. Other limitations of this rapid literature review include incomplete capture of rapidly emerging studies on the Delta variant. As well, there are varying definitions in the literature for what is considered a breakthrough case which may impact risk assessment in the Ontario context.

There is a range of options for enhancing case and contact management in the context of the highly infectious Delta variant. As the province enters the fourth wave of the pandemic, there is an urgent need to remain vigilant with our existing public health measures and strengthening current case and contact management guidance to reduce the risk of transmission from SARS-CoV-2.

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