COVID-19 Omicron (B.1.1.529) Variant of Concern and Communicability...What We Know So Far

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Introduction

Public Health Ontario (PHO) is actively monitoring, reviewing and assessing relevant information related to Coronavirus Disease 2019 (COVID-19). “What We Know So Far” documents provide a rapid review of the evidence related to a specific aspect or emerging issue related to COVID-19.

Key Findings

- The Omicron (B.1.1.529) variant of concern (VOC) has displaced Delta (B.1.617.2) as the dominant severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) lineage in many jurisdictions, including Ontario. There is substantial scientific and experiential evidence that Omicron is more transmissible, has a higher growth rate, higher attack rate and a higher basic reproduction number (R₀) than other lineages.

- The period of communicability for Omicron peaks at an estimated 3–6 days post symptom-onset (PSO), which is slightly shorter than that reported for the wild-type lineages (3–8 days PSO).

- The estimated mean incubation period for Omicron is approximately 3–4 days, which is likely shorter than that reported for the wild-type lineages (4.2–6.7 days).

- The estimated mean serial interval for Omicron is 2–3 days, which is likely shorter than that reported for the wild-type lineages (4.5–5.4 days).

Background

Omicron was designated a VOC by the World Health Organization (WHO) on November 26, 2021. It is currently the dominant SARS-CoV-2 variant circulating in Ontario. The risk of increased Omicron transmission in Ontario is high, with low degree of uncertainty. The risk of increased disease severity is moderate with a moderate degree of uncertainty. While evidence suggests possible reduced disease severity relative to Delta, the high and rapidly rising number of Omicron cases from increased transmission may result in substantial numbers of severe cases. The high number of individuals infected with Omicron threatens health care delivery due to increasing individuals seeking health care and decreasing availability of health care personnel who are infected by or exposed to SARS-CoV-2.

The Ontario government updated the provincial self-isolation guidance on December 30, 2021.
- Fully vaccinated individuals or children under the age of 12 with COVID-19 symptoms and/or a positive test result (rapid antigen, rapid molecular, or PCR) are required to isolate for five days following symptom-onset or positive test, whichever came sooner (reduced from 10 days in the previous guidance).

- Individuals who are unvaccinated, partially vaccinated or immunocompromised and have COVID-19 symptoms or a positive test result are still required to isolate for 10 days.

- Household contacts of an individual with a positive test result or with COVID-19 symptoms are required to isolate (isolation time requirements based on vaccine status as noted above), while non-household contacts are required to self-monitor their symptoms for 10 days without self-isolation provided they are fully vaccinated or self-isolate if they are not fully vaccinated.

- Individuals who work in highest-risk settings (e.g., hospitals, paramedic services, congregate living settings, correctional facilities) are recommended to avoid work for 10 days following symptom onset; however, there are provisions in the guidance to allow earlier return to work for cases and contacts of cases in the context of critical staffing shortages.⁴

The objective of this evidence brief is to summarize evidence on characteristics relevant to the communicability of Omicron, specifically:

1. Transmissibility
2. Period of communicability
3. Incubation period
4. Serial interval

Methods

In considering feasibility, scope and timelines, we undertook a rapid review to assess Omicron variant communicability. A rapid review is a knowledge synthesis where certain steps of the systematic review process are omitted for timeliness (e.g., duplicate screening).⁵

PHO Library Services conducted searches of primary and preprint literature on January 11, 2022, using MEDLINE, Embase and National Institutes of Health COVID-19 Portfolio (preprints) databases for literature related to the communicability of Omicron. Search strategies are available upon request. English-language peer-reviewed and non-peer-reviewed records that described Omicron communicability were included in this synthesis. Additional articles and grey literature identified for related PHO Scientific and Technical Requests work with relevance to this topic were also included.

Prior to publishing, PHO subject matter experts review all What We Know So Far documents. As the scientific evidence is expanding rapidly, the information provided in this document is only current as of the date of respective literature searches.

Topics out of scope for this document include SARS-CoV-2 routes of transmission, host factors (e.g., immunosuppression, comorbidities), environmental factors (e.g., ventilation, cleaning, stressor), vaccine effectiveness and other public health and personal mitigation measures (e.g., IPAC, social distancing, test-based clearance) potentially modifying communicability dynamics. We address these and other related topics in other PHO products, which can be accessed at the Coronavirus Disease 2019 (COVID-19) webpage.⁶
Transmissibility

Transmissibility refers to how easily an infectious virus spreads from an infected individual to susceptible individuals. Transmissibility is impacted by multiple factors including characteristics of the virus itself, biological and behavioural characteristics of infected and susceptible individuals, population-level factors (e.g., widespread public health measures, immunity) and environmental conditions.

There is substantial scientific and experiential evidence that Omicron is more transmissible than Delta, including Omicron’s rapid displacement of Delta as the dominant SARS-CoV-2 lineage in many jurisdictions.\(^\text{7-10}\) Modelling, \textit{in vitro}, and \textit{in-silico} analyses support current epidemiological findings and suggest potential mechanisms behind the higher rate of transmission of Omicron;\(^\text{11-15}\) however, it remains unclear to what extent the increased transmissibility is due to inherent characteristics of the virus (i.e., enhanced ability to infected cells) and/or immune evasion. Indicators such as attack rates and the basic reproduction number (\(R_0\)) can provide insight into Omicron transmission patterns.

Omicron Attack Rate, Growth Rate and Reproduction Number

High rates of community and/or household Omicron transmission have been reported, including evidence of higher case growth rate, attack rate, and reproduction number compared to Delta.\(^\text{8,16-29}\) Eight records were included in this synthesis, with relevant findings summarized below.

- An analysis of the growth rate of Omicron in Ontario for specimens collected from November 1 to December 23, 2021 estimated Omicron cases had a 48% (selection coefficient: 0.24; 95% confidence interval [CI]: 0.23–0.26) faster daily growth rate relative to non-Omicron cases.\(^\text{21}\) On average, each case of Omicron in the province during that time had infected 3.5 times more individuals than Delta (95% CI: 3.3–3.8).

- Using Danish register data from December 2021, among 11,937 households (including 2,225 primary cases with Omicron), the estimated secondary attack rate was 31% and 21% in households with Omicron and Delta, respectively (Lyngse et al. 2021) (preprint).\(^\text{17}\) The secondary attack rate for unvaccinated individuals was 29% for Omicron households and 28% for Delta households, while for fully vaccinated individuals it was 32% and 19%, respectively. For booster-vaccinated individuals, the secondary attack rate was 25% for Omicron and 11% for Delta. Comparing Omicron households to Delta households, the secondary attack rate was 1.2 (95% CI: 0.99–1.38) times higher for unvaccinated, 2.6 times (95% CI: 2.34–2.90) higher for fully vaccinated, and 3.7 times (95% CI: 2.65–5.05) higher for booster-vaccinated individuals.

- Out of 33 people who attended a private gathering in early December 2021 in the Faroe Islands, 21 tested positive for SARS-CoV-2 (attack rate = 63.6%) (Helmsdal et al. 2021) (preprint).\(^\text{22}\) The high attack rate triggered targeted sequencing for Omicron and found 13 samples from the gathering and four from infected contacts were Omicron.

- In an Omicron outbreak (81 cases out of 117 attendees) at an indoor Christmas party in November 2021 in Norway, Brandal et al. (2021) reported that 96% (107/111) of attendees had received two doses of a COVID-19 vaccine and reported a negative COVID-19 test (i.e., RAT, RT-PCR) within two days before the event.\(^\text{20}\)

- In a report from Korea using Omicron cases (n=131) from November 25 to December 16, 2021, Kim et al. (2021) (preprint) estimated that \(R_0\) was 1.9 (95% credible interval [CrI]: 1.50–2.43), which is higher than an earlier estimate for the Delta variant in Korea, which was 1.0.\(^\text{8}\)
In Denmark, Ito et al. (2021) examined 758 Omicron cases reported up to December 7, 2021 and estimated that the $R_e$ was 3.2 (95% CI: 2.82–3.61). In England, a logistic growth model using community-based adjusted S-gene target failure (SGTF) counts from non-travellers estimated $R_e$ at 3.7 (95% CI: 3.3–4.2) based on a generation time of 5.2 days and a coefficient of variation of 2/3. The adjusted odds ratio (aOR) of household transmission of Omicron vs. Delta was 3.2 (95% CI: 2.0–5.0; p<0.001). Authors adjusted for age, sex, ethnicity, index of multiple deprivation, type of residence, specimen date, number of household contacts, region and vaccination status of the index case, or prior COVID-19. The aOR of a close contact becoming a case from confirmed Omicron versus Delta index cases was 2.1 (95% CI: 1.54–2.79). Close contacts included household members, face-to-face contacts, and people within one meter of the case for ≥1 minute or within two meters for 15 minutes. Enhanced contact tracing may have contributed to higher observed secondary attack rates.

Modelling of Omicron transmissibility using United Kingdom (UK) data estimated Omicron to be 5.6-fold more transmissible than Delta (95% CrI: 5.26–5.90) and using data from South Africa was estimated to be 3.1-fold more transmissible than Delta (95% CrI: 2.72–3.43).

Period of Communicability

The period of communicability (i.e., infectiousness) is the duration of time that an individual infected with SARS-CoV-2 may transmit the virus to others. For this rapid review, we infer the period of communicability of COVID-19 from studies investigating:

1. Live virus culture
2. Epidemiology and contact tracing
3. Modelling
4. Viral RNA shedding

Live, replication-competent virus refers to the detection of a cytopathic effect in cell cultures or the isolation of live virus from cell cultures inoculated with clinical samples from patients with COVID-19. In general, the presence of live virus in a sample from a patient with COVID-19 is an indication that the patient is infectious; however, this does not always equate to infectiousness, as infectiousness is dose-dependent and other factors may impact downstream transmissibility. Similarly, the absence of live virus in a sample does not always equate lack of infectiousness, as virus culture is a manual process requiring significant expertise and is usually constrained by higher limits of detection compared with other testing methods.

Viral RNA shedding provides additional evidence for the period of communicability and refers to the detection of targeted RNA segments in patient samples through PCR. A positive PCR result may or may not represent the presence of replication-competent virus, as the RNA detected could instead only be due to fragmented or residual viral particles without any infectivity risk. Epidemiological studies with contact tracing are another indicator of the period of communicability, including for the presymptomatic period if accurate tracing of presymptomatic cases and their close contacts was conducted.

Modelling studies, using information from the other types of evidence, provide additional insights into the period of communicability. Specifically, modelling studies are important for extrapolating the extent of presymptomatic transmission and the period when transmission risk is highest.
On February 8, 2021, PHO published *COVID-19 Overview of the Period of Communicability – What We Know So Far*, prior to the emergence of Delta and Omicron.31

In that rapid review, the primary findings were:

- Epidemiology studies found transmission occurred as far back as 3–5 days before symptom-onset (BSO) and epidemiology, virus culture and modelling studies found transmission occurred as late as 8–10 days PSO in index cases.

- While specific period of communicability estimates varied among the reviewed studies, there was concurrence that the risk of communicability peaked shortly before and after the time of symptom onset in index cases.

While we can generalize the period of communicability for SARS-CoV-2, we should highlight that there are factors that may shorten or prolong the period of communicability. Please see PHO’s *Factors Affecting COVID-19 Period of Communicability – What We Know So Far* for potential factors affecting the period of communicability (e.g., immune compromise).32

**Omicron**

There was limited evidence available regarding the period of communicability of the Omicron VOC. Seven studies were included in this synthesis; only two studies included results for the Omicron variant.

- In an epidemiological study of Omicron transmission in Japan (November 2021 to January 2022), the National Center for Global Health and Medicine (2022) reported on infectious viral shedding in 21 patients infected with the Omicron variant (19 of 21 vaccinated).33 The amount of viral RNA (using cycle threshold \([C_t]\) values from RT-PCR) and viable virus detection (using culture) peaked at 3–6 days PSO or diagnosis, dropping rapidly by 10 days PSO. For symptomatic cases, viable virus in culture was isolated in 12.5% (2/16) of cases at 0–2 days PSO, 50.0% (4/8) at 3–6 PSO, 18.8% (3/16) at 7–9 days PSO, 0% (0/12) 10–13 days PSO, and 0% (0/10) at >14 days PSO. Four of the cases were asymptomatic and 17 had mild disease. The authors defined Day 0 as date of symptom onset or specimen collection for diagnosis. The authors concluded that vaccinated Omicron cases are unlikely to shed infectious virus 10 days after diagnosis or PSO.

- In a high-risk occupational case cohort of 30 Omicron cases initially diagnosed by saliva RT-PCR (United States [US]) (December 2021), Adamson et al. (2022) (preprint) reported that the cases were potentially infectious (based on RT-PCR \(C_t\) values <29 as a surrogate for infectiousness according to the study authors, although no viral culture was done) up to two days BSO.34 The researchers then serially recorded 62 nasal rapid antigen tests (RAT) and saliva RT-PCR results from specimens collected in the subsequent days from their initial diagnosis. All RATs produced false-negative results up to 2 days BSO, despite 28 of 30 pairs with saliva RT-PCR \(C_t\) values <29 around the same time. The median time from first positive saliva PCR to first positive nasal RAT was 3 days (95% CI: 2–not applicable). The study also collected a third specimen in parallel, nasal RT-PCR, from 5 of the 30 cases to assess comparability of collection sites. Viral loads peaked in saliva RT-PCR 1–2 days before nasal RT-PCR. RATs were usually positive by the time nasal RT-PCR viral loads peaked. We should note that the study population was biased since only those with positive saliva PCRs were recruited, and authors are board members of a company called SalivaDirect.
- A preprint modelling study from the UK Health Security Agency (UKHSA), in the context of Omicron, suggested that up to 31% of infected individuals may still remain infectious at 5 days PSO, decreasing to 16% at 7 days PSO, 5% at 10 days PSO, and 1% at 14 days PSO.\textsuperscript{35}

- The US Centers for Disease Control and Prevention (CDC) reported that their recommendation to cut isolation periods for infected people from 10 to five days incorporated unpublished modelling on the spread of the Delta variant that found the risk of transmission was 13% five days after someone tested positive.\textsuperscript{36,37}

**Ontario Data**

Modelling from PHO’s laboratory data and public health’s case and contact management (CCM) tool has found that Omicron does not appear less infectious over time compared to other variants.\textsuperscript{38,39} Based on estimates of Ct values by days PSO, modelling data suggests nearly equivalent viral loads around the time of symptom-onset compared to prior lineages. The viral load dynamics over time also suggest that the period of communicability is not reduced compared to prior lineages and may be increased in certain instances (e.g., in breakthrough infections). With other VOCs, a faster reduction in viral load from infection was seen in vaccinated cohorts as opposed to unvaccinated individuals.\textsuperscript{40,41} In the case of Omicron; however, there does not seem to be a more rapid viral clearance in vaccinated groups.\textsuperscript{39}

PHO laboratory data from July 1 to November 30, 2021, when Delta was the dominant variant, shows that the median Ct value of positive SARS-CoV-2 specimens tested on the laboratory-developed PCR testing platform (LDT) ranged from 23.6 to 26.7 for asymptomatic cases and 21 to 22.1 for symptomatic cases.\textsuperscript{38,39} From December 15–20, 2021, as Omicron became the dominant variant, the median Ct value of positive samples ranged from 20.7 to 24.1 for asymptomatic cases and 18.3 to 22.1 for symptomatic cases (regardless of vaccine status).

Overall, there was a trend towards slightly lower Ct values during the period of December 15–20, 2021, compared to the period of July 1 to November 30, 2021, especially among breakthrough infections. This could suggest slightly increased infectivity risk in these populations, although further analyses are needed to address whether these differences are statistically significant. One hypothesis could be that the reduced vaccine effectiveness against Omicron could lead to higher viral loads seen in vaccinated populations as compared to Delta in vaccinated populations.

**Other VOCs and Wild-type SARS-CoV-2**

We included four new studies obtained in the updated search conducted for this synthesis which examined the residual risk of infected individuals transmitting non-Omicron SARS-CoV-2 (i.e., risk of transmission following quarantine and isolation).

- Siedner et al. (2021) compared viral shedding and culture positivity in vaccinated individuals (n=22) with either Delta infection or non-Delta variant infection (Alpha, Gamma, Mu) in Massachusetts, US (January to August 2021).\textsuperscript{42} Individuals with Delta breakthrough infections had a higher initial viral load, slower viral load decay assessed by RT-PCR (median: 13.5 days vs. 4 days), and a non-significant trend towards longer duration of culturable virus (median: 7 days vs. 3 days) (hazard ratio [HR]: 0.38, 95% CI: 0.14–1.02) compared to non-Delta variants. All Delta infections (8/8) were symptomatic, compared with 64% (9/14) of non-Delta infections.
Salvatore et al. (2021) examined viral shedding markers in vaccinated and unvaccinated individuals in a US federal prison during a Delta variant outbreak. Ninety-five individuals participated (78 vaccinated, 17 not fully vaccinated) and provided 978 mid-turbinate nasal specimens between July 12 and August 4, 2021, which were collected for 10 days following the individual’s testing confirmation of being infected. No significant differences were detected in duration of RT-PCR positivity among fully vaccinated participants (median: 13 days) versus those not fully vaccinated (median: 13 days) (p=0.50). For the duration of culture positivity, no significant difference was found between those who were vaccinated or not fully vaccinated (medians: 5 days vs. 5 days; p=0.29).

Kang et al. (2021) retrospectively analyzed data of laboratory-confirmed COVID-19 infection with Delta in Guangdong, China in May and June 2021. From 94 transmission pairs, infectiousness was estimated to peak at 2.1 days (95% CI: 1.5–2.7) BSO, and 97.1% (95% CI: 94.4–99.0) of transmissions occurred within 4 days PSO. Vaccination status of the cases was not taken into consideration.

Shrestha et al. (2020) evaluated the residual risk of infected individuals to transmit SARS-CoV-2 (pre-VOCs) based on days PSO, and estimated the risk was 10.9–13.7% after 5 days, 2.7–3.1% after 7 days, and 0.3% after 10 days PSO.

**Incubation Period and Serial Interval**

The incubation period is the time from exposure to an infectious agent (i.e., SARS-CoV-2) to when an individual develops symptoms. Public health officials use the tail end of the incubation period range to determine the quarantine period for communicable diseases. The serial interval is the time from symptom-onset in the index case to symptom-onset in the secondary case(s) (infector-infectee pairs). The distribution of the serial interval is important for estimating R0 and for informing policy decisions (e.g., contact tracing: shorter serial interval means that contacts need to be isolated quickly BSO).

On December 17, 2020, PHO published COVID-19 Epidemiological Parameters – What We Know So Far, prior to Delta and Omicron emergence. At the time, the main findings were:

- The estimated mean incubation period for COVID-19 ranged from 4.2 days to 6.7 days; 95% of patients presented with symptoms within 11.2 days to 11.7 days after exposure.

- The estimated mean serial interval for COVID-19 ranged from 4.5 days to 5.4 days.

**Omicron**

There was limited literature available regarding the incubation period and serial interval of Omicron. Six studies were included in this synthesis and summarized below.

- Out of 33 people who attended a private gathering in early December 2021 in the Faroe Islands, 21 tested positive for SARS-CoV-2 (attack rate = 63.6%) (Helmsdal et al. 2021) (preprint). Upon follow-up, 13 of the 21 cases, plus four contacts, were infected with Omicron variant. The mean incubation period was 3.2 days (95% CI: 2.87–3.60), assuming the exposure was at the gathering.
• An Omicron outbreak (81 cases out of 117 attendees) occurred at an indoor Christmas party in November 2021 in Norway (Brandal et al. 2021). 20 96% of attendees were vaccinated with two doses of a COVID-19 vaccine and attendees were asked to have a negative COVID-19 test (RAT or PCR) within two days of the event. The index case was a traveller that recently returned from South Africa. If attendees were infected at the party, the incubation period for symptomatic cases (n=81) ranged from 0–8 days, with a median of 3 days.

• A household cluster (n=6) of Omicron (identical genotype) occurred in Nebraska, US, in November to December 2021 (Jansen et al. 2021). 25 The index case was unvaccinated, had just returned from Nigeria and had a prior SARS-CoV-2 infection in November 2020. Four secondary cases had prior infection, of these four, one had received two doses of mRNA COVID-19 vaccine and three were unvaccinated. One secondary case was neither vaccinated nor previously infected. The median incubation period was approximately 73 hours (range: 33–75).

• Lee et al. (2021), in a brief communication article from South Korea, examined 26 transmission cases from households and 12 from church-related clusters between November 24 and December 10, 2021. 47 The authors did not consider vaccination status, though it was noted that 60% of the 80 Omicron cases identified in that period were unvaccinated. The estimated incubation period was 4.2 days (range: 2–8), and the serial interval was 2.8 days (range: 1–7).

• In South Korea, Kim et al. (2021) (preprint) examined the serial intervals of Omicron symptomatic cases confirmed by whole-genome sequencing from November 25 to December 16, 2021. 8 Vaccination status not considered; however, 80% of the population in South Korea has been vaccinated with two doses of COVID-19 vaccine as of early December 2021. The mean serial interval was 2.2 days (95% credible interval: 1.48–2.97) based on 18 transmission pairs (contacts were isolated for 14 days from exposure).

• Abbot et al. (2022) (preprint) analyzed daily growth rates for Omicron and Delta in the UK from November to December 2021. The authors estimated a shorter generation time distribution for Omicron with a mean of 1.5–3.2 days and a standard deviation of 1.3–4.6 days, assuming a generation time distribution for Delta with a mean of 2.5–4 days (90% CrI) and a standard deviation of 1.9–3 days.46 The authors estimate that these estimates resulted in a 160–210% transmission advantage for Omicron, compared to Delta. The authors note that other factors, including differences in immune escape between the variants could have played a role.

Limitations

Of the 23 records included in this synthesis, only five were peer-reviewed published studies. 20,29,30,45,47 Ten of the 23 records were preprint studies 8,17,19,22,34,35,42,44,48 and eight were grey literature records; 21,26,27,31–33,39,46 thus, were not peer-reviewed and should be interpreted with caution.

Common challenges for observational studies include relative small study samples, and difficulty accounting for various factors affecting communicability (e.g., immune status), and potential sources of infection aside from the identified index case, and accounting for asymptomatic cases. In addition, culturing SARS-CoV-2 is technically challenging and labour intensive; therefore, the lack of positive cultures does not necessarily indicate an absence of infectious virus. Finally, most studies used samples of convenience, resulting in findings that may not be applicable across all populations.

Evidence related to the Omicron VOC is rapidly evolving and conclusions may change as newer, high-quality research becomes available. Degrees of confidence and uncertainty are indicated in the conclusions below to reflect this.
Conclusions

While there was limited primary literature available, the available literature does suggest some differences in the communicability of the Omicron variant compared to previous VOCs and the wild-type lineages of SARS-CoV-2:

- The transmissibility of Omicron is higher (high degree of confidence, low degree of uncertainty)
- The period of communicability of Omicron is likely slightly shorter (peaking at 3–6 days PSO vs. 3–8 days PSO) (low degree of confidence, high degree of uncertainty)
- The incubation period of Omicron is likely shorter (3–4 days vs. 4–7 days) (low degree of confidence, high degree of uncertainty)
- The serial interval for Omicron is likely shorter (2–3 days vs. 4.5–5.5 days) (low degree of confidence, high degree of uncertainty)

PHO will continue to assess the scientific literature on Omicron VOC communicability and update this document when changes to the key findings are warranted.

Practice Implications: Length of Self-isolation for Cases and Length of Quarantine for Contacts

Shortening the isolation period for cases and quarantine period for contacts aims to balance the risk of residual transmission after discontinuing isolation/quarantine versus the burden of homestay on individuals, households and the workforce (particularly essential workers). If a case or contact leaves isolation/quarantine while still unknowingly infectious, there is risk of further chains of transmission. Limited evidence suggests asymptomatic transmission may be more common in Omicron cases than Delta cases. When implementing a shorter isolation periods for cases and quarantine period for contacts, considerations should be given to:

- COVID-19 pandemic response goals (e.g., reduce transmission, maintain health system capacity, reduce morbidity and mortality).
- Risk tolerance and the impacts on society (including the health system and essential services) of a potential increase in cases resulting from higher rates of transmission.
- Maintaining existing public health measures to help mitigate any potential increases in transmission that may result from shortened isolation and quarantine periods. Measures include vaccination, decreasing social contacts, physical distancing, masking, ventilation and hand hygiene in a multi-layered strategy.
- Differential approaches based on number of vaccine doses (based on vaccine effectiveness) and natural immunity (based on natural immunity protection) among those who were recently positive.
- Specific settings where risk tolerance may be lower, due to the vulnerability of certain populations (e.g., long-term care homes, congregate settings, acute care facilities) and consideration of more cautious approaches and measures for these settings.
- The role of testing (rapid antigen, rapid molecular, and/or PCR), if any, when there is a residual risk of transmission after discontinuation of isolation/quarantine period.
References


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