**Topic:** In acute care and long-term care settings, is there potential risk of a healthcare worker (HCW) quarantine period which is shorter than the currently recommended 14 days after a potentially significant COVID-19 exposure?

1. What is the risk of infection transmission from HCWs to others if a quarantine period is shorter than 14 days?
2. Does this risk of infection transmission vary across a range of COVID-19 case exposures (e.g., asymptomatic case, symptomatic case, or severely symptomatic case exposure; or by different types of symptoms; or different types of exposure) or levels of PPE worn?
3. What is the optimal timing and frequency of post exposure testing in order to detect early infection and reduce the risk of occupational transmission to others if shortening the post-exposure quarantine period?
4. What HCW quarantine guidelines do other jurisdictions use following an exposure?

**Context**

- There are preventable exposure risks to HCW daily when providing care to patients with confirmed or suspected COVID-19. Similarly, there are preventable risks of exposure to SARS-CoV-2 (COVID-19) infected individuals in community settings or amongst co-workers in work settings.
- Current management of exposures involves assessment for quarantine, monitoring, and testing if symptoms develop with the aim of reducing the risk of transmission from exposed and potentially infected HCWs to others (patients, colleagues, etc.).
- It is critical that the health system remain able to provide sustainable patient care for patients with COVID-19 and patients without COVID-19 while avoiding excess risk of COVID-19 transmission within healthcare settings. Currently, following a significant occupational exposure, Alberta HCWs are required to quarantine for 14 days. However, recommendations vary between jurisdictions around the world.
- To best inform evolution of HCW quarantine policy, a review of current literature was requested to delineate and if possible quantify any risks associated with shorter quarantine periods of HCW to help plan workforce needs under varied circumstances, understanding there are risks associated with the inability to staff healthcare settings adequately (to both staff and patients).
- AHS data on self-isolating employee numbers suggests that at initial peak there were a maximum of 564 AHS employees isolating (March 28, 2020) and since the beginning of September approximately 20-130 HCW are on self-isolation daily (these data do not include physicians, and the majority comprise RNs, HCA/NA, LPNs). [https://tableau.albertahealthservices.ca/#/views/AHSSStaffReporting/ESPExceptionsNEW?:iid=1](https://tableau.albertahealthservices.ca/#/views/AHSSStaffReporting/ESPExceptionsNEW?:iid=1) There is currently (October 20, 2020) 0.1% of the workforce isolating and 1.4% listed as sick, however the majority of those isolating are usually associated with specific focal units and sites or outbreaks which could significantly impact provision of care in specialty areas.

**TERMINOLOGY USED IN THIS REPORT**

*Quarantine (self-isolation)* is the time period when asymptomatic people that have been exposed to an infectious disease are sequestered or stay alone and minimize all contact with others (including household members where possible) for the duration of an expected incubation period in order to contain the spread of a disease and prevent transmission to others.
**Isolation** refers to the separation of people who are sick with compatible symptoms and probable infection, or with laboratory confirmed active infection in the communicable phase of illness from those individuals who do not have such symptoms and are unexposed.

**Work Restriction** is when an individual is not allowed to return to work until they have completed a period of quarantine or isolation.

In this document, **quarantine** will be the term used to refer to asymptomatic persons restricting contact with others, and **isolation** will refer to symptomatic persons restricting contacts with others.

**Key Messages from the Evidence Summary**

- There is a paucity of high-quality studies that directly address this review question in HCW populations.
- The risk to HCWs of contracting SARS-CoV-2 is quite varied across reports and studies are often confounded by 1) higher rates of testing in HCWs; 2) not using a health care workforce denominator to contextualize the relative risk of HCW versus non-HCW; 3) lack of investigation into the source of the individual HCW infections; and 4) population incidence and transmission and its influence on non-occupational exposures. In Alberta occupational HCW COVID-19 testing and infection rates are tracked and the infection rate in HCW is currently lower than the community rate of infection.
- Transmission risk is dynamic, and is impacted by several factors including 1) Source individual characteristics including mask use; phase of infection (with the highest risk starting just before or at symptom onset through 7 days after symptom onset) and presence of symptoms (particularly respiratory symptoms; 2) Contact parameters including the cumulative duration and type of contact (direct contact to secretions, close indoor contact <1-2 meters) and 3) Presence of protective factors including personal protective equipment (PPE) use, hand hygiene, physical distance and environment-ventilation. Some groups present HCW risk classifications (low, moderate, high) based on hospital ward or contact parameters and PPE; however, there is heterogeneity among the risk criteria presented across studies and guidelines.
- Studies of screening data suggests that anosmia/ageusia, fever, and loss of appetite are fairly conserved symptoms that are associated with a positive SARS-CoV-2 PCR test in data from Alberta and elsewhere.
- There is limited evidence specific to the question of time from exposure to onset and test performance in exposed HCWs, so community or population studies are also included. A community based study on testing characteristics in predominantly symptomatic persons is also referenced.
- Some data suggest most transmission occurs within 5 days after symptom onset; other data suggest transmission also can occur from 2 days prior to symptom onset. This is relevant in the dynamics of health care based outbreaks, as it would suggest that greater risk to HCWs is likely due to undiagnosed COVID-19 positive patients or coworkers, rather than patients who are hospitalized with recognizedCOVID-19 (who often present after several days of symptoms when infectivity is declining). This would support prevention strategies (PPE, hand hygiene, distancing, fit for work symptom checking) that reduce the risk from undiagnosed contacts.
- Virologic and transmission studies show that both cultivatable virus and transmission risk decline markedly by day 7 post symptom onset, so otherwise well HCWs with known exposure and a defined symptom onset date could reasonably return to work 7-10 days after symptom onset. It is noted that longer carriage of viable virus has been associated with critical illness and severely immunosuppressed states, which would not usually be relevant clinical considerations in HCWs who are able to and willing to return to work.
- Optimal timing of testing has been evaluated but available data are from symptomatic testing predominantly. Available evidence suggests false negative rates among symptomatic cases is lowest at day 8 post-exposure (20% false negative rate at day 8), and post-test probability of a positive test result varies based on pretest probability of exposure risk (high risk scenarios vs low risk scenarios). See Subquestion 3 for more details.
• Testing during quarantine has not been systematically evaluated to assess its use in reducing the risk of undiagnosed incubating infection but asymptomatic and pre-symptomatic people have been shown to have detectable RT-PCR and cultivatable virus (please refer to SAG Asymptomatic Review, 2020).

• Evidence directly addressing work restrictions or quarantine following occupational exposure in HCWs is limited. Available evidence suggests that the symptom onset occurs at a median of 5 days post exposure, and that late symptom development is fairly rare, with <10% of infected individuals developing symptoms after day 10 post-exposure. Higher risk exposures (which are variously defined) are predictive of a positive test. The findings are supportive of a quarantine period of less than 14 days in non-high risk (usual risk) exposures. However, these findings need to be considered within the context of data limitations. See Question 2 sub-section on time from last exposure to symptom onset for more details.

• A summary of policies from across national and international jurisdictions shows that 10 and 14 days HCW quarantine periods are both suggested. No specific evidence reviews or rationale documentation were found.

Committee Discussion
The committee agreed with establishing standardized terminology and with formulating a recommendation around terminology. Discussion around whether a single recommended quarantine period was reasonable or whether high and low risk exposures should be handled differently was quite detailed with compelling points raised on both sides. Rearranging the recommendations and ensuring the weakness of the evidence base is reflected was suggested.

Recommendations for Consideration
**Recommendation 1:** For HCW assessed as having a usual risk exposure, a shortened 10-day quarantine period (from the last exposure) prior to consideration of return to work can be recommended, assuming the following conditions are met:

- The HCW did not have a high risk exposure (see below) and has remained asymptomatic; and
- The HCW has tested RT-PCR negative at day 8 following their last exposure to a case; and
- The HCW confirms they do not have any high risk exposures (including ill household contacts or known community COVID-19 case exposures) in the preceding 14 days; and
- The HCW agrees to adhere to standard recommendations for: continuous masking coupled with recommended hand hygiene practices, appropriate PPE use, continued self-monitoring for symptoms and fitness for work screening.

**Rationale:** The median day of symptom onset post exposure is day 5. The risk of developing symptoms after day 10 post exposure is modest (5-10% across studies), and negative RT-PCR testing at day 8 post exposure should reduce the risk associated with the return to work of a HCW who is potentially infectious while in a pre-symptomatic or paucisymptomatic infectious state. Use of masking and distancing in household/community studies has been shown to reduce transmission risk by potentially a further 80% even when using potentially less efficient cloth masks (see Figure 1). The risk of a HCW returning to work with transmissible infection would be further reduced by self monitoring for symptom development, fitness for work screening, and appropriate PPE, however, existing studies have not been explicit in exploring the magnitude of protective effect that monitoring and PPE use combined may have on reducing transmission from HCWs. As such, this recommendation is based on an evolving evidence base, with smaller studies of lower quality. It is also noted that the Chief Medical Officer of Health ultimately is responsible for determining the duration of quarantine.

**Recommendation 2:** For HCW assessed as having a high-risk exposure (with high risk elements on contact assessment as per Workplace Health and Safety guidance, or significant exposure in a high risk exposure event) a 14-day quarantine period from last exposure is recommended prior to consideration of return to work.

**Rationale:** While “high risk” status needs to consider the individual circumstances for each HCW (as assessed by WHS), in this evidence review, it was clear both the contact assessment (as described in Figure 1, including elements such as distance, duration, PPE) and involvement in a high risk exposure event should be considered. There is no validated tools to stratify exposure risk, so a combination of existing literature and expert opinion was used to derive the following risk assessment considerations.
Examples of elements of contact assessment in clinical settings that suggest higher risk include:

- Source case unmasked, with respiratory symptoms
- Multiple exposures or prolonged exposure (cumulative time > 15 minutes) to a source case when the case was -1 to +5 days in relation to symptom onset, without adequate PPE
- Close contact where direct droplet contamination of respiratory mucous membranes has been reported (direct body fluid exposure)
- Prolonged (> 15-minute) exposure to an aerosol generating medical procedure with inadequate PPE, or exposure to an AGMP without any PPE

An illustration of a high risk exposure with many of these elements would be: exposure in a confined space (example: break room); or meal sharing without masks for > 15 minutes and with < 2 meters distancing when the source case was within days -1 to +5 in relation to symptom onset.

- A pragmatic definition of a “high risk exposure event” is as follows:
  - Exposure in an outbreak with the possibility of a high attack rate based on the evolving scenario, or exposure to a source case with demonstrated spread to others with similar exposure characteristics during the source cases higher risk of transmissibility period.

Recommendation 3: HCW who have documented COVID-19 must isolate for 10 days post-symptom onset (or after documented acute RT-PCR positivity if no symptoms develop) prior to consideration for return to work, with the exception that immunocompromised HCW require specific WHS clearance to consider return to work before 14 days from symptom onset.

**Rationale:** Virologic and transmission studies show that both cultivatable virus and transmission risk decline markedly after day 7 post-symptom onset, so otherwise well HCWs with known exposure and a defined symptom onset date could reasonably return to work by 10 days after symptom onset. Strict adherence to PPE and distancing recommendations upon return is recommended. Some data suggest that prolonged shedding of potentially viable virus may be seen in severely immunocompromised and critically ill persons, so this recommendation does not apply to immunocompromised HCWs. Although most individuals on immunomodulatory therapy are unlikely to need longer quarantine or be at risk of prolonged viral shedding, there is evolving evidence in this area. Therefore, WHS assessment with incorporation of evolving evidence around viral kinetics and testing in immunocompromised persons is suggested.

**Discussion of Recommendations**

- HCWs with no symptoms during quarantine (self-isolation) after an exposure are at progressively less risk of manifesting infection over the duration of quarantine. A risk quantification approach was undertaken. Community-based studies suggest the median day of symptom onset post exposure is 5 days, and most people (75%) develop symptoms by day 7; however, 5-10% may develop symptomatic infection after 10 days post exposure. A review of guidelines reveals most international jurisdictions recommend quarantine for 14- or 10-days post exposure.
  - Extended work restriction (14 days) for all potentially exposed HCWs is the most conservative option but may strain ability to provide safe and adequate care within the healthcare system, including possibly increasing risk to overextended HCWs during periods of staffing shortfall.
  - Risk stratifying HCWs who may be eligible for expedited return to work is of potential value. This review and in-development WHS guidelines support clarifying and stratifying risk of exposures by type of PPE use and type of contact. Risk stratification by expected attack rate has also been suggested conceptually in papers around likelihood of symptomatic infection development (Lauer et al., 2020) and in papers looking at PCR test performance characteristics in defining likelihood ratio (Kucirka et al, 2020).
  - However, in this review we observe that HCW attack rates vary considerably in the literature, supporting the importance of risk dispersion (superspreading events) in COVID-19 transmission as suggested by Endo A et al. (2020). Although not reported directly in this literature, the stage of infection of the source case (early/pre-symptomatic with high viral load) appears to be a likely root cause of this observation, as this could influence fomite, short and long range droplet and contact spread in health care settings.
Although the overall likelihood of occupationally-acquired COVID-19 infection in HCWs presently is lower than the likelihood of community-based infection in Alberta, mitigating the risk of workplace transmission after shorter isolation periods requires thorough evaluation of the exposure event (as outlined in current WHS documents), optimized testing, and guidance around return to work risk mitigation measures.

- Risk Mitigation measures are anticipated to reduce risk of transmission from any COVID-19 infected asymptomatic HCW after a 10 day return to work including: testing by RT-PCR at day 8 post last exposure, daily symptom screening, and continuous masking with enhanced hand hygiene.

Practical Considerations:

1. Local data collected around HCW exposures should continue to inform evolution of these recommendations optimally with data fields that include first and last day of exposure, whether the exposure was in a high risk exposure event setting (setting of known transmission from that source, or a high intensity unit outbreak), PPE use, duration, distance, and time of collection, and time of results of PCR tests. In addition, the AHS WHS symptom questionnaire which includes documentation of symptoms, indicating which were initial symptoms and which were dominant symptoms could be used and the results incorporated into risk screening algorithms.

2. These recommendations focus on to reducing the risk of workplace transmission from COVID-19 exposed HCW by establishing minimum quarantine periods based on likelihood of incubating infection and testing characteristics, as well as defining the minimum isolation period after COVID-19 infection based on virologic parameters. These recommendations do not address the assessment of an individual HCW’s ability to return to work after illness, which should be based on their overall health status and recovery.

Research Gaps

Studies defining the utility of asymptomatic testing in exposed populations such as HCWs were not found and there exists relatively minimal data on HCW exposure types and consequent infection rates that would allow better definition of high risk exposures and assessment of PPE. Most often, the existing studies use self-report for HCW status and do not stratify to compare HCW and non-HCW findings. Future studies should address these gaps. There remains great heterogeneity across terms used and how they are defined, so efforts to validate term definitions such as exposure risk levels will strengthen the evidence based and allow for more robust analyses. High quality evidence from jurisdictions with similar contexts to Alberta will be needed to further support the development of strong evidence-based recommendations from the evolving evidence.

Future efforts to construct and validate level of risk definitions and high-quality evidence to quantify the relationship between level of exposure risk and transmission would support decision makers to align evidence-based definitions to the local context.

Summary of Evidence Quality

HCWs have a crucial role in the ongoing COVID-19 pandemic. Reducing infection risks for both HCWs and patients while maintaining adequate staffing levels to provide patient care for all is a critical balance. HCWs face potential exposures to SARS-CoV-2 which necessitates strict adherence to Infection, Prevention and Control (IPC) measures, including use of personal protective equipment (PPE) and hand hygiene. It is widely supported that accessible RT-PCR testing should be made widely available to HCWs who have COVID-19 symptoms or exposures. There is a paucity of evidence supporting the most appropriate interval for HCW quarantine following a significant exposure incident, how or if this interval changes across different types of exposures and levels of PPE, and the possible role of testing HCWs following exposure to best detect infection prior to HCWs returning to work. The quality of the identified studies ranged from moderate to low and study limitations should be considered when interpreting the findings, which often included smaller sample sizes and sampling bias, early case definitions for COVID-19, data linkages across multiple data sources, self-reported data and lack of delineation between groups (e.g., community vs HCW data; symptomatic vs presymptomatic vs asymptomatic). The following sections are a rapid review of the existing COVID-19 literature pertaining to this topic.

As this is a rapid review and evidence about SARS-CoV-2 is ever-changing, the included studies are not exhaustive. For feasibility of a rapid review, a targeted search strategy was applied to the primary question and its
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sub-questions. The search was designed to target the body of literature related to HCWs, as such there are potentially additional studies examining time from exposure to symptom onset in patients and/or the community that were not captured by the search terms. Key non-HCW references identified by hand searching have been included; however, as always, there is complexity in the terms used for criteria such as HCWs and occupational exposure, and so multiple terms and synonyms were applied to the search to mitigate this risk. Finally, the available literature is often limited to studies not yet peer-reviewed (pre-print) or grey literature/jurisdictional reports.

DETAILED EVIDENCE REVIEW:
In acute care and long-term care settings, what is the risk of a healthcare worker (HCW) quarantine period which is shorter than the currently recommended 14 days after a potentially significant COVID-19 exposure?

Subquestion 1: What is the risk of infection transmission from HCWs to others if a quarantine period is shorter than 14 days?

SYNTHESIS OF FINDINGS ACROSS STUDIES
Individual studies did not adequately address the review question of what quarantine periods sufficiently mitigate risks and thus Table 1 below combines data around attack rate (proportion of the exposed who contract SARS-CoV-2 during a defined time interval [e.g., quarantine during work restriction]), timing of symptoms from exposure, and testing characteristics post exposure to describe the risk of an exposed asymptomatic healthcare worker being potentially infected/capable of transmitting infection at various times post exposure. A more granular review of these and other papers is presented in the Detailed Evidence Review section. To frame the finding of the literature review, we also provide Figure 1 below to summarize a current understanding of factors that increase and mitigate transmission risk.

Using data from three studies that include community-based data (i.e., not specific to HCWs) (Kucirka et al., 2020; Luo et al., 2020; McAloon et al., 2020), looking only at exposed individuals who acquire infection, and the timing of their symptoms after exposure, Table 1 presents crude estimates of risk scenarios across two levels of attack rates in HCWs (lower rate of 1% [attack rate in healthcare settings from Luo et al., 2020] and higher rate of 10% for superspreading events). The table then applies the risk level definitions from Kucirka et al (2020) that estimates low risk exposures equate to 50% of the overall attack rate and high risk exposures are estimated to be 4X the overall attack rate (Row A). Available data from the literature estimates that 5-10% of infected people may not have obvious symptoms at day 8-10 but almost all would develop symptoms over the ensuing week (day 15 to day 17) (Row B). Findings from Kucirka and colleagues’ analysis of infected cases estimates the lowest false-negative rate for pre-symptomatic cases to be 20% on day 8 (Row B). The risk of positive cases not showing symptoms by day 10 who test negative (PCR) on day 8, by the estimated attack rate and level of risk are presented in Row D.

It should be noted that the data presented around false negative testing, and likelihood ratios is from studies that were not confirmed to asymptomatic persons; however, as asymptomatic and pre-symptomatic people can have low CT/high viral load positive tests it is reasonable to use these data for this illustration. Data on test performance in asymptomatic exposed persons would be preferred and could be incorporated into updates of this work if it is published.
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Table 1. Risk of missing an infected HCW who has no symptoms at day 10, and had a negative RT-PCR at day 8 (assuming a false negative rate of 20%) at different levels of infection risk/prevalence

<table>
<thead>
<tr>
<th>Row</th>
<th>Risk consideration</th>
<th>Assuming an attack rate of 1%</th>
<th>Assuming an attack rate of 10% (outbreaks, superspreading events)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Risk definitions from Kucirka et al (2020): Low risk: 50% of overall attack rate High risk: 4X overall attack rate</td>
<td>Lower risk exposure Overall attack rate Higher risk exposure Lower risk exposure Overall attack rate Higher risk exposure</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.5% (50% of 1%) 1% 4% (4X 1%)</td>
<td>5% (50% of 10%) 10% 4% (4X 10%)</td>
</tr>
<tr>
<td>B</td>
<td>Infected cases without symptoms by day 10 (that will eventually develop symptoms) using two study estimates Luo et al. 10% by day 8 McAloon et al 10% by day 10</td>
<td>5% 10% 5% 10% 5% 10% 5% 10% 5% 10%</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>20% false negative rate (lowest at day 8) (Kucirka et al. 2020)</td>
<td>20% 20% 20% 20% 20% 20% 20% 20% 20% 20%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Negative Predictive Value at given attack rate or prevalence</td>
<td>99.91 99.83 99.30 99.13 98.14 89.81</td>
<td></td>
</tr>
<tr>
<td>D</td>
<td>Risk of missing Infected HCW at day 10 (assuming negative test at day 8 and no symptoms as of Day 10) (Row A x Row B x Row C)</td>
<td>0.005% -OR- 0.01% -OR- 0.01% -OR- 0.02% -OR- 0.04% -OR- 0.08% -OR- 0.05% -OR- 0.1% -OR- 0.1% -OR- 0.2% -OR- 0.4% -OR- 0.8% -OR- 0.05 per 1,000 0.1 per 1,000 0.1 per 1,000 0.2 per 1,000 0.4 per 1,000 0.8 per 1,000 0.5 per 1,000 1 per 1,000 1 per 1,000 2 per 1,000 1 per 4,000 8 per 1,000</td>
<td></td>
</tr>
</tbody>
</table>

A sample of interpretations would be as follows:

- Assuming an attack rate of 1%, a lower risk exposure (0.5%) and 5% of symptomatic cases do not show symptoms at day 10, the risk of missing an infected HCW at day 10 (assuming negative test at day 8 and no symptoms as of day 10) is 1/20,000.
- Assuming an attack rate of 1% (not adjusted for level of risk exposure) and assuming 10% of symptomatic cases do not show symptoms at day 10, the risk of missing an infected HCW at day 10 (assuming negative test at day 8 and no symptoms as of day 10) is 1/5,000.
- Assuming an attack rate of 10% (not adjusted for level of risk exposure) and assuming 5% of symptomatic cases do not show symptoms at day 10, the risk of missing an infected HCW at day 10 (assuming negative test at day 8 and no symptoms as of day 10) is 1/1,000.
- Assuming an attack rate of 10%, a high risk exposure (40% [4X attack rate]) and assuming 10% of symptomatic cases do not show symptoms at day 10, the risk of missing an infected HCW at day 10 (assuming negative test at day 8 and no symptoms as of day 10) is 1/125.

If an infected individual was to return to work after a false negative test, the risk of the HCW transmitting infection to another staff or patient or a visitor is an important consideration. This risk would be affected both by the
estimated transmission from infected individuals in healthcare settings (non-household contact) and use of PPE. In a study of 3,410 close contacts, the transmission rate to household contacts was 10.3% compared to 1% in healthcare contacts (OR 0.09) and 0.1% (OR .01) on public transportation. In this study, the risk of transmission from an asymptomatic person in the community was estimated to be 0.3% (CI, 0.0 to 1.0%), with increasing risk with symptoms as follows: 3.3% (CI, 1.8% to 4.8%) for mild, 5.6% (CI, 4.4% to 6.8%) for moderate, and 6.2% (CI, 3.2% to 9.1%) for severe or critical cases (Luo et al., 2020). Thus, contacts of an asymptomatic HCW may have approximately 0.3% risk of transmission, which would be expected to be reduced by PPE use as "source control."

In the systematic review by Chu et al (2020), masks reduced healthcare-based coronavirus transmission (protection of wearer) from 18% to 3% (aOR 0.15), and eye protection reduced transmission from 16% to 6% (aOR 0.22) (Chu et al., 2020) based on limited observational studies of health care exposures to SARS, MERS and SARS-CoV-2. Given the inclusion of data on community and household contacts in the meta-analysis, as well as masking being a complex intervention, these reductions in risk are possibly underestimates. In household settings, facemask use by both the case and contacts reduced transmission by 80% (OR 0.21) in a study in Beijing (Wang et al., 2020). Therefore, the baseline asymptomatic transmission risk may be reduced further, to 0.063% (.3% X .21) using the household example and reduced further still to contacts who are also wearing masks and eye protection (0.3% X .15 X 0.22 = 0.01%). All these estimates are limited by the data available, and do not incorporate the possibility of superspreading events, given the high dispersion of transmission (in which relatively few cases are responsible for the majority of transmission).

Figure 1: (reference: Cevik et al, 2020)

**Factors Influencing Transmission of COVID-19**

**Source:**
- SYMPTOMS increase risk (especially cough, fever)
  - presymptomatic exposure 37% less risk
  - Asymptomatic exposure 65% less risk
- MASK as source control 80% less risk
- Infectivity - high viral load, can transmit before and early in symptoms
  - highest risk 2 days before through 4 days after symptoms, drops after day 6

**Exposed:**
- Personal protective equipment:
  - MASK
  - eye protection
  - in healthcare setting: gown and gloves
- Actions:
  - proper donning and doffing
  - hand hygiene
- Susceptibility
  - Evolving knowledge: previous infection (within 7 months) may reduce risk of reinfection

**Contact patterns ↑ risk:**
- ↑DURATION (> 15 min)
- ↑FREQUENCY
- ↑PROXIMITY (<1-2 m)
- Type of contact: healthcare/respiratory secretions, meal sharing

**SETTING risks – indoor (increased risk 18.7X), poor ventilation, inadequate cleaning high touch surfaces**

**Alberta Data (WHS)**
From the AHS HCW Testing Dashboard, data pertaining to HCWs with occupationally acquired infections were reviewed (n = 62). Among symptomatic cases with a date of first exposure (n=53), the median number of days since first exposure to symptom onset was 5 days (75% by day 8, 90% by day 12 and 95% by day 14). Median time from last exposure to symptom onset (n=53) was 4 days (75% by day 5, 90% by day 8 and 95% by day 10). For symptomatic cases, median time was 9 days from first exposure to a positive test result (75% by day 12, 95%
by day 20) and a median of 7 days from last exposure to first positive test (75% by day 10, 95% by day 14). For the asymptomatic cases (n = 3), 2 case had first and last exposure on the same day (1 case 4 days between exposure to positive test, 1 case experienced 11 days between exposure to positive test). The third asymptomatic case only had one exposure and a positive test occurred 11 days later.

Comparing the preliminary analysis of initial Alberta HCW data (described in detailed evidence review below) to a community-based sample from Luo et al. (2020) described previously, the time to symptom onset from last exposure was slightly longer in the Alberta HCW set; however, detailed of methodology and follow up parameters are in evaluation.

<table>
<thead>
<tr>
<th>Days from last exposure</th>
<th>Cumulative % of cases with symptoms by day from last exposure</th>
<th>Cumulative % of cases with symptoms by day from last exposure</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) &lt;=5 days</td>
<td>1) 88%</td>
<td>WHS Data AHS</td>
</tr>
<tr>
<td>2) &lt;=7 days</td>
<td>2) 90.5%</td>
<td></td>
</tr>
<tr>
<td>3) &lt;=10 days</td>
<td>3) 94.9%</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4) &lt;=14 days</td>
<td>4) 98.9%</td>
<td></td>
</tr>
<tr>
<td>5) &gt;14 days</td>
<td>5) 100%</td>
<td></td>
</tr>
</tbody>
</table>

**SUMMARY: Subquestion 1**

In this review, the identified studies did not directly address the review question of what quarantine period is optimal in balancing risks of transmission from infected but asymptomatic HCW versus risks of health system sustainable operation. The current evidence base on this topic is limited both in breadth and study quality. Therefore, data across studies that addressed at least one aspect of the review questions, including those with community-based data, were compiled to create a table stratifying the risk of missing an infected HCW at day 10 (assuming negative test at day 8 and no symptoms as of Day 10). This illustrates two attack rates (1% and 10%) across a range of low and high risk exposure attack rates (defined in studies based on the presence and use of appropriate PPE and physical distancing). When assuming an attack rate of 1%, risk thresholds range from 1/20,000 (when assuming a lower risk exposure event and assuming 5% of symptomatic cases develop symptoms after day 10) to 1/1,250 (when assuming a higher risk exposure event and that 10% of symptomatic case develop symptoms at day 10. When assuming an attack rate of 10% risk thresholds range from 1/2,000 (assuming lower risk exposure and 5% become symptomatic after day 10) to 1/125 (assuming higher risk exposure and 10% become symptomatic after day 10). There is no defined threshold of “acceptable” risk and the balancing risk of inadequate staffing to provide care is crucial in determining a health system approach. On balance, the committee thought that risk stratification can be used to define non high risk (“usual risk” scenarios where available data support 10 day quarantine. It is noted that this is already the recommendation in some jurisdictions internationally, but that efforts to improve the clarity of contact assessment for risk, and high risk exposure setting is seen as prudent.

**Subquestion 2: Does this risk of infection transmission vary across a range of COVID-19 case exposures (e.g., asymptomatic case, symptomatic case, or severely symptomatic case exposure; or by different types of symptoms; or different types of exposure) or levels of PPE worn?**

**BACKGROUND: HCW risk of acquiring COVID-19**

Current assessment of the risk of contracting SARS-CoV-2 for HCWs is quite varied. Existing studies are often confounded by 1) higher rates of testing in HCWs as compared with the non-HCW populations; and 2) lacking a definition of HCW (and sometimes relying on voluntary self-report), as well as not using a health care workforce denominator to contextualize the relative risk of HCW versus non-HCW; and 3) population incidence and transmission and its influence on non-occupational exposures. In the [HCW Risk SAG Review](#), derived
Researchers have used health care workforce estimates to suggest a HCW relative risk (RR) of about 10 fold higher than the general population, with absolute risk varying from 0.01% in low-risk countries to 3.44% in high-risk countries. Alberta Workplace Health and Safety (WHS) data (current as of October 5th) show that 626 of 54,344 employees have tested positive (0.97%), of which so far 83 of the 439 (18.9%) of fully investigated cases were felt to be occupationally acquired for a current occupational infection rate of 0.15%. It is also notable that the HCW testing rate is about 5X higher than the general population. For comparison, in Alberta overall, as of October 8, using confirmed cases and reported census population, 0.45% of the population has been infected. Alberta's real-time dashboard data on HCW testing and infection is unique, particularly as it incorporates a denominator of HCW types, and these data support the practices thus far in maintaining HCW safety during the pandemic.

Internationally, reports from China (110/9,684 HCW tested PCR positive) and the Netherlands (86/9,705 HCW tested PCR positive) suggest a higher infection rate of ~1% (Kluytmans-van den Bergh et al., 2020; Lai et al., 2020), whereas a study from India reported HCW infection rate as 7.1% for high-risk exposures (40/560 high-risk exposures PCR positive) (Kaur et al., 2020). A recent living rapid review reported infection rates among HCWs to range between 0.4% to 23.5% in RT-PCR studies (Chou et al., 2020). Nationally, a Canadian Institute for Health Information (CIHI) snapshot from July 23rd shows HCWs in Canada accounted for 19.4% of confirmed COVID-19 cases (CIHI, 2020) which may reflect both increased testing and a potentially increased exposure although that is not able to be assessed. In a more detailed assessment from Ontario, Schwartz et al. (2020) conducted a cross-sectional study comparing HCW and non-HCW COVID-19 PCR confirmed cases between Jan 21-May 14, 2020. Cases in HCWs were 5.5 times higher than non-HCWs (765.5 per 100,000 vs. 139.5 per 100,000, respectively). HCWs were also found to experience a milder clinical course than non-HCWs (4.1% requiring hospitalization & 0.2% death vs 21.7% & 10.5%) which would suggest potentially better case finding through higher testing. Of those with symptoms at diagnosis, HCWs experienced more atypical symptoms than non-HCWs (17.8% vs 10.5% p<.001). In this cohort, asymptomatic positivity was also more common in HCWs (8.1% vs 7.0%, p.01).

Early data from a longitudinal study of SARS-CoV-2 positivity and seroprevalence in high-risk HCWs and hospital staff (COVID-19 unit, COVID-19 ICU, emergency department) in Brussels found no significant difference in risk of infection between HCWs providing direct patient care and other staff (no direct patient care) (p=.1) which authors attribute to good adherence to IPC measures (Martin, et al., 2020). In another study using a mobile app to collect symptoms and testing data (with resulting risk of reporting bias) the Cox proportional adjusted hazard ratios (aHRs) derived from a population-based mobile application study on 2,135,190 participants (4.7% of which HCWs) reported that compared to the general community, aHRs for HCWs varied by work setting: inpatient units (aHR: 24.3, 91%CI: 21.8, 27.1), nursing homes (aHR: 16.2, 95%CI: 13.4, 19.7) and hospital-based clinics (aHR: 7.86, 95CI%: 5.63, 11.0) (Nguyen et al. 2020).

For further details on HCW risk, please see the HCW Risk SAG Review or the living rapid review in Annals of Internal Medicine.

EXPOSURE RISK

Existing Classifications of HCW Exposure Risk

When looking to classify the risk level of a given exposure, definitions vary across authors (Table 2). Some authors classify by known or likely COVID-19 patient presence, although some studies have suggested lower transmission risk in these areas (e.g., emergency department, intensive care unit), potentially because of enhanced precautions and strong protocols. Commonly, duration and type of contact, and PPE use are mentioned, as well as the potential transmissibility by infection stage inferred by timing of infection.

Table 2. Sample of risk level definitions

<table>
<thead>
<tr>
<th>Reference</th>
<th>Definition of Low Risk</th>
<th>Definition of Moderate Risk</th>
<th>Definition of High risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mponponsuo K, et al. (2020). Lack of nosocomial transmission to exposed inpatients and coworkers in an investigation of five SARS-CoV-2--infected healthcare workers. Infection Control &amp; Hospital Epidemiology <a href="https://doi.org/10.1017/ice.2020.392">https://doi.org/10.1017/ice.2020.392</a></td>
<td>Close contact defined as &gt;15mins at distance &lt;1m</td>
<td>Close contact defined as &gt;15mins at distance &lt;1m</td>
<td>Close contact defined as &gt;15mins at distance &lt;1m</td>
</tr>
</tbody>
</table>
**Research Question**

<table>
<thead>
<tr>
<th>Authors</th>
<th>Title</th>
<th>Background Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rivett L, et al.</td>
<td>Screening of healthcare workers for SARS-CoV-2 highlights the role of asymptomatic carriage in COVID-19 transmission.</td>
<td>Green: Hospital areas with no patients with positive SARS-CoV-2 RT PCR results, nor patients clinically suspected to have COVID-19. Amber: Hospital areas with patients pending SARS-CoV-2 RT-PCR test results, or with patients who may have been exposed to and incubating the virus. Red: Hospital areas with patients who tested SARS-CoV-2 RT-PCR positive, or patients with very high clinical suspicion of COVID-19.*</td>
</tr>
<tr>
<td>Böhmer MM, Buchholz U, Corman VM, Hoch M, Katz K, Marosevic DV, et al.</td>
<td>Investigation of a COVID-19 outbreak in Germany resulting from a single travel-associated primary case: a case series.</td>
<td>Any exposure not meeting definition of high risk were classified as low risk Contacts that had cumulative face-to-face contact with a confirmed case for ≥ 15 mins, direct contact with secretions or body fluids of a patient with confirmed COVID-19, or in the case of health-care workers, had worked within 2 m of a patient with confirmed COVID-19 without personal protective equipment</td>
</tr>
<tr>
<td>Kaur R., Kant S., Bairwa M., Kumar A., Dhakad S., Dwarakanath V., et al.</td>
<td>Risk stratification as a tool to rationalize quarantine among health care workers exposed to COVID-19 cases – Evidence from a tertiary healthcare centre in India.</td>
<td>Any exposure not meeting definition of high risk were classified as low risk Contact with a confirmed case in the following circumstances: - case or contact not wearing a mask and within &lt;1m - AGMP without at any: N95 OR gloves OR eye/face protection -respiratory tract secretions, saliva or body fluid came in contact with mucous membrane or non-intact skin - household contact of confirmed case</td>
</tr>
<tr>
<td>Heinzerling A, Stuckey MJ, Scheuer T, Xu K, Perkins KM, Resseger H, et al.</td>
<td>Transmission of COVID-19 to Health Care Personnel During Exposures to a Hospitalized Patient - Solano County, California, February 2020.</td>
<td>Close contact with patient for a total of 2 hours but not during aerosol-generating procedures – staff reported wearing facemask and gloves most of the time but removed the mask occasionally to speak and did not wear eye protection Longer duration and frequent contact of exposure to the patient with COVID-19. Transmission based precautions were not in use, no HCP wore PPE recommended for COVID-19 patient care during contact with the index patient.</td>
</tr>
<tr>
<td>Tubiana S, Burdet C, Houhou N, Thy M, Manchon P, Blanquart F, et al.</td>
<td>High-risk exposure without personal protective equipment and infection with SARS-CoV-2 in healthcare workers: results of the CoV-CONTACT prospective cohort.</td>
<td>Exposure was considered to be at high-risk of SARS-CoV-2 transmission if it occurred i) face-to-face, within one meter and without protective surgical or FFP2/N95 mask, and ii) during a discussion or while the index had an episode of coughing or sneezing, and iii) in the 72 hours prior to, or following the virological diagnosis, or during the symptomatic period of the index.</td>
</tr>
<tr>
<td>Hunter BR, Dbeibo L, Weaver CS, et al.</td>
<td>Seroprevalence of severe acute respiratory coronavirus virus 2 (SARS-CoV-2) antibodies among healthcare workers with differing levels of coronavirus disease 2019 (COVID-19) patient exposure [published online ahead of print, 2020 Aug 3].</td>
<td>Hospital setting had admitted &lt;30 confirmed COVID-19 positive cases Hospital setting had admitted at least 30 confirmed COVID-19 positive cases</td>
</tr>
<tr>
<td>Korth J, Wilde B, Dolf S, et al.</td>
<td>No daily patient contact</td>
<td>Daily non-COVID-19 patient contact</td>
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<tr>
<td>----------------------------------</td>
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<tr>
<td>SARS-CoV-2-specific antibody detection in healthcare workers in Germany with direct contact to COVID-19 patients. J Clin Virol. 2020;128:104437. doi:10.1016/j.jcv.2020.104437</td>
<td>Close contact with COVID-19 case wearing surgical mask &amp; HCW with: - no goggles or face shield; OR - no gloves or gown; - full PPE but with a surgical mask</td>
<td>Close contact with COVID-19 case not wearing surgical mask &amp; HCW with: - no surgical mask OR - no PPE use</td>
</tr>
<tr>
<td>Maltezou HC, Dedoukou X, Tseroni M, Tsonou E, Raftopoulos V, Papadima K, Mouratidou E, Poufta S, Panagiotakopoulos G, Hatzigeorgiou D, Sipsas N. SARS-CoV-2 infection in healthcare personnel with high-risk occupational exposure: evaluation of seven-day exclusion from work policy. Clinical Infectious Diseases. 2020 Jun 29. *increased exposure risk in cases of direct contact with a COVID-19 case **increased exposure risk when aerosol-generating procedure or uncontrolled respiratory secretions</td>
<td>Close contact with COVID-19 case not wearing surgical mask &amp; HCW with: - no surgical mask OR - no PPE use</td>
<td>Close contact with COVID-19 case not wearing surgical mask &amp; HCW with: - no surgical mask or FFP2 - no PPE use</td>
</tr>
<tr>
<td>Villanueva AM, Lazaro J, Sayo AR, H;P;SM, Ukiawa T, Suzuki S, Takaya S, Telan E, Solante R, Ariyoshi K, Smith C. COVID-19 screening for healthcare workers in a tertiary infectious diseases referral hospital in Manila, the Philippines. The American journal of tropical medicine and hygiene. 2020 Sep 2:103(3):1211-4. Brief interactions with a COVID-19 patient or prolonged contact close contact with a patient wearing a cloth mask/face mask while HCW wears a face mask or respirator</td>
<td>Prolonged close contact with a COVID-19 patient with face mask while HCW does not wear a mask or goggles; prolonged close contact with a patient while HCW wears gloves, gown, eye protection and a face mask during an aerosol generating procedure</td>
<td>Prolonged close contact with a COVID-19 patient while both HCW and patient do not wear a face mask; same-room exposure to aerosolizing procedures on a COVID-19 patient and HCW is without mask or goggles</td>
</tr>
<tr>
<td>Suárez-García I, de Aramayona López MM, Vicente AS, Abascal PL. SARS-CoV-2 infection among healthcare workers in a hospital in Madrid, Spain. Journal of Hospital Infection. 2020 Oct 1;106(2):357-63. Minimal level of occupational exposure to COVID-19 cases (e.g., administrative workers, social workers, hospital management, and pharmacy, pathology and preventative medicine departments)</td>
<td>HCWs with occasional contact with COVID-19 patients: other medical and surgical departments not included in low-and-high-risk groups</td>
<td></td>
</tr>
<tr>
<td>Workers who are not in contact with patients, such as laboratory and administrative personnel</td>
<td>Working in other clinical departments in same health setting as COVID-19/pneumonia patients</td>
<td></td>
</tr>
<tr>
<td>Workers who are in occasional contact with patients with COVID-19 (e.g., surgery, pediatrics, non-COVID-19 related medical areas)</td>
<td>HCWs with occasional contact with COVID-19 patients: other medical and surgical departments not included in low-and-high-risk groups</td>
<td></td>
</tr>
<tr>
<td>Workers belong to emergency room or hospital areas with high concentration of COVID-19 patients, as well as areas of intensive care and resuscitation</td>
<td>HCWs with occasional contact with COVID-19 patients: other medical and surgical departments not included in low-and-high-risk groups</td>
<td></td>
</tr>
</tbody>
</table>
EXPOSURE RISK: RISK ASSESSMENT

With respect to occupationally exposed HCWs, a prospective cohort study (Maltezou et al., 2020) of HCWs with an occupational exposure in Greece were classified as low, moderate or high risk exposures (moderate and high risk exposures involve a 7 day quarantine; risk definitions included in Table 2). Out of 3,398 exposed HCWs, 1,594 HCWs were tested by PCR regardless of the presence of symptoms, of which 76 were confirmed positive for COVID-19 (4.8%). High risk exposure (missing or no PPE including no continuous masking; required to quarantine for 7 days) were found to be significantly associated with a positive PCR test (OR: 3.58, 95%CI: 1.94, 6.58, p<.001) (Maltezou et al., 2020). In India, a cohort of 3,853 HCWs (defined as all hospital staff) that were exposed to 321 confirmed cases (patients and HCWs) were tested by PCR following exposure (Kaur et al., 2020). High risk exposures required 14-day quarantine (with a 6.3% infection rate in those asymptomatic at testing) whereas low risk workers were able to continue working while following appropriate PPE guidelines and IPC measures (with a 2.1% infection rate in those asymptomatic at testing) (risk definitions in Table 2). Low risk exposures (85.5%) were more common than high risk (14.5%). High risk exposures were most often the result of inappropriate PPE use. The overall infection rate was 3.1% (n=118/3,853). 7.1% of HCWs with a high-risk exposure (95%CI: 5.2, 9.6, n=40) tested positive for COVID-19. Symptomatic HCWs with a high risk exposure had a higher positivity rate (10.2%, 95%CI: 5.5, 16.7) than those asymptomatic at the time of testing (6.3%, 95%CI: 3.9, 8.5), which was also seen among low risk HCWs that were symptomatic (5.3% 95%CI: 3.0, 8.7) and asymptomatic (2.1%, 95%CI: 1.6, 2.6) (Kaur et al., 2020).

An additional study by Fell et al recently reported that HCW assessed as having high risk exposures had an overall positivity rate of 6.9%, with the lowest infection rate in acute care and the highest in group homes and other congregate settings (9.6%). In this report, higher-risk exposures occurred when HCP had close, prolonged contact with a person with confirmed COVID-19 or their secretions or excretions, while not wearing recommended PPE, or close, prolonged contact with persons with COVID-19 in the household or community. HCP exposed to household or social contacts with COVID-19 had the highest positivity rate (13%) among all exposure types. The median number of days from last exposure to symptom onset was 7 (IQR 5-10). It is notable that 56.6% of HCW were asked to return to work during monitoring, and 48.1% did return to work. Overall 3.2% of HCW reported working while symptomatic while in a monitoring period.

EXPOSURE RISK: SOURCE PATIENT FACTORS

Symptoms:
Severity of the index case symptoms have not been formally incorporated into risk stratification. A prospective cohort study from Guangzhou, China evaluated the risk of SARS-CoV-2 transmission among 3,410 close contacts of 391 index cases across different contact settings (including healthcare settings) and found the secondary attack rate to be positively associated with the severity of the index case (asymptomatic 0.3% CI: 0.0, 1.0; mild 3.3% CI: 1.8, 4.8; moderate 5.6% CI: 4.4, 6.8; severe/ critical 6.2% CI: 3.2, 9.1; p<.001) (Luo et al, 2020). Most of the transmission described in this study was in household contacts so the presence of symptoms (especially expectoration- productive cough) associated with severity, as well as potentially longer-term household exposures over the course of an evolving symptomatic illness may be factors. Notably, all index cases were included based on symptomatic findings with only a small percentage of cases identified based on surveillance testing (3.7%), resulting in bias in the asymptomatic cases. Secondary attack rate by index case severity was not a primary outcome of this study and there is bias around the identification of asymptomatic cases. This study was conducted early in the pandemic and uses early case definitions for COVID-19 and symptoms so are not inclusive of all COVID and secondary symptoms. However, a systematic review (Qiu X, et al., 2020) also suggested that the risk of asymptomatic transmission (0-2.8%) is consistently lower than symptomatic transmission (0.7-16.2%)
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in the same studies. Another study suggested that asymptomatic risk (0.25%) is less than pre-symptomatic risk (0.63%) compared with symptomatic transmission (Cevik et al, 2020). A shortcoming in these data is that index cases are easier to identify if symptomatic and the degree of undocumented transmission is excluded from transmission analyses.

Stage of infection:
An additional important source patient factor is transmissibility related to viral load and phase of infection. Data from three studies suggests the duration of live viral detection ends by day 8 (Bullard et al, 2020; van Kampen et al, 2020; Wölfel et al, 2020). Some data suggest most transmission occurs within 5 days of symptom onset, with other data suggesting high levels of virus are present from day -2 to +2/3 of symptoms (Cheng H-Y et al, 2020). It is notable that no transmission occurred to contacts occurring after day 5 of symptoms (with similar findings in other studies [SAG Asymptomatic Review, 2020]) which may be relevant in the dynamics of health care based outbreaks, suggesting that greater risks are likely due to undiagnosed COVID-19 positive patients or coworkers, and supports strategies that reduce that risk. See SAG Asymptomatic Review for further details.

EXPOSURE RISK: NATURE OF CONTACT
Factors that have been shown to influence risk across healthcare and community setting contacts include increased duration, frequency, proximity of contact, and types of activities between the individuals (Cevik et al., 2020) for example, outside healthcare: meal sharing, conversation at close proximity; within healthcare: contact with upper aerodigestive tract secretions, aerosol generating procedures. The contact setting also may influence risk: indoor risk is 18.7 times outdoor risk, and considerations in the built environment where exposure occurs such as airspace, ventilation (potentially humidity and fraction of external air) and fomite transmission if environmental cleaning of high touch surfaces is suboptimal (Nishiura et al, 2020) (see SAG HVAC review).

EXPOSURE RISK: PPE USE & DISTANCE
A major mitigating factor in reducing infections in exposed HCWs is the use of PPE. A systematic review and meta-analysis published by Chu et al (2020) included seven SARS-CoV-2 transmission studies as well as healthcare setting studies of SARS and MERS. This meta-analysis of severe coronavirus transmission risk found that odds of transmission significantly decreases beyond 1m of distance compared to <1m (adjusted OR [AOR]: 0.18, 95%CI 0.09, 0.38), equating to a risk difference of ~10% with relative risk (RR) decreased 2-fold per additional m of distance. In this analysis, face mask use was associated with risk reduction (AOR 0.15, 95%CI: 0.07, 0.34). Eye protection data were of lower certainty with an AOR 0.22 (95%CI: 0.12, 0.39). Notably, this study has been criticized for including only observational trials, and for aspects of the data extraction from the SARS and MERS studies (in assigning distance for example), as well as conflicting findings from subsequent follow-up analyses on the same studies. For more detailed information on physical distancing, please refer to the Physical Distancing SAG Review. HCWs without adequate PPE are at higher risk for COVID-19 infection than those with appropriate PPE (Nguyen et al., 2020; Self et al., 2020). Nguyen et al. (2020) reported that HCWs with inadequate PPE during direct contact with a positive case had an aHR of 5.91 (95%CI: 4.53, 7.71) compared to those with appropriate PPE based on HCW self-reported mobile app data described above. Selection bias in self-reported risks may be a weakness of this study.

ASSESSMENT OF HCW SYMPTOMS IN PREDICTING COVID-19 STATUS
Common symptoms reported in cases of COVID-19 include respiratory and gastrointestinal symptoms as well as other COVID-19 related symptoms such as headache, loss of smell or taste, and fatigue (IPAC, 2020; PHAC, 2020). A clinician’s guide produced by the Public Health Agency of Canada (PHAC, 2020) identifies ranges of prevalence for symptoms associated from with COVID-19 from the literature, with loss of taste and/or smell (58%-88%), fever (44-91%) and cough being among those most commonly reported symptoms and others less frequent such as muscle aches (11-44%), sputum production (28-33%) and nausea/vomiting (5-19%). Headache was found to have a wide range of reported prevalence (6-70%).

With respect to Alberta HCWs, a prepublication dataset was shared for this review, using the Communicable Disease Outbreak Management (CDOM) database with a subset of 1,434 HCWs with RTPCR testing and a symptom questionnaire completed between March 1 to September 30, 2020. Tested individuals were
The symptoms most commonly associated with a positive RT-PCR test in HCW were: anosmia/ageusia (positive likelihood ratio [PLR]: 8.7, 95%CI: 3.28, 23.06), decreased appetite (PLR: 4.37, 95%CI: 1.40, 13.65), muscle/joint pain (PLR: 2.61, 95%CI: 1.59, 4.27), fever/fevered chills (PLR: 2.58, 95%CI: 1.81, 3.68) and difficulty breathing/dyspnea (PLR: 2.37, 95%CI: 1.12, 4.99). Symptoms not associated with a positive PCR result were: chest pain (PLR: 3.73, 95%CI: 0.92, 15.16), sneezing (PLR: 2.52, 95%CI: 0.93, 6.81), fatigue (PLR: 1.69, 95%CI: 0.62, 4.63), diarrhea (PLR: 1.63, 95%CI: 0.84, 3.15), nausea/vomiting (PLR: 1.37, 95%CI: 0.70, 2.66) and nasal congestion (PLR: 1.37, 95%CI: 0.98, 1.92). These data may be of benefit in designing a follow-up tool for exposed persons and HCW education around symptoms. Comparing HCW data to the overall Alberta population data with a completed symptoms-based questionnaire (positive PCR n=11,702, negative PCR n=3,430, total n=15,132; inclusive of HCWs), gastrointestinal symptoms were associated with a positive test in the general population (e.g., diarrhea PLR: 2.67, 95%CI: 2.22, 3.22; nausea/vomiting PLR: 2.67, 95%CI: 2.18, 3.28) whereas these were not associated with a positive test in HCW.

Table Alberta Data: Symptoms in health care workers tested for SARS-CoV-2 infection

<table>
<thead>
<tr>
<th>Frequency in HCW with positive SARS-CoV-2 swab (n= 1260)</th>
<th>Frequency in HCW with negative SARS-CoV-2 swab (n= 174)</th>
<th>Odds Ratio (95% CI)</th>
<th>Positive LR for SARS-CoV-2 infection if that variable is present in the 1434 health care workers investigated in CDOM (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anosmia/ageusia</td>
<td>252 (20.0%)</td>
<td>10.63 (3.90, 28.91)</td>
<td>8.70 (3.28, 23.06)</td>
</tr>
<tr>
<td>Decreased appetite</td>
<td>95 (7.5%)</td>
<td>4.65 (1.46, 14.83)</td>
<td>4.37 (1.40, 13.65)</td>
</tr>
<tr>
<td>Diarrhea</td>
<td>106 (8.4%)</td>
<td>1.68 (0.84, 3.39)</td>
<td>1.63 (0.84, 3.15)</td>
</tr>
<tr>
<td>Nausea/vomiting</td>
<td>89 (7.1%)</td>
<td>1.39 (0.69, 2.82)</td>
<td>1.37 (0.70, 2.66)</td>
</tr>
<tr>
<td>Malaise</td>
<td>312 (24.8%)</td>
<td>2.16 (1.37, 3.41)</td>
<td>1.87 (1.26, 2.77)</td>
</tr>
<tr>
<td>Fever/fevered chills</td>
<td>505 (40.1%)</td>
<td>3.64 (2.38, 5.57)</td>
<td>2.58 (1.81, 3.68)</td>
</tr>
<tr>
<td>Headache</td>
<td>469 (37.2%)</td>
<td>2.05 (1.41, 2.98)</td>
<td>1.66 (1.25, 2.21)</td>
</tr>
<tr>
<td>Fatigue</td>
<td>49 (3.9%)</td>
<td>1.72 (0.81, 3.43)</td>
<td>1.69 (0.62, 4.63)</td>
</tr>
<tr>
<td>Muscle/joint pain (myalgia, arthralgia, muscular, joint pain)</td>
<td>283 (22.5%)</td>
<td>3.07 (1.78, 5.30)</td>
<td>2.61 (1.59, 4.27)</td>
</tr>
<tr>
<td>Sneezing</td>
<td>73 (5.8%)</td>
<td>2.61 (0.94, 7.24)</td>
<td>2.52 (0.93, 6.81)</td>
</tr>
<tr>
<td>Chest pain</td>
<td>54 (4.3%)</td>
<td>3.85 (0.93, 15.94)</td>
<td>3.73 (0.92, 15.16)</td>
</tr>
<tr>
<td>Conjunctivitis</td>
<td>12 (1.0%)</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Nasal congestion</td>
<td>327 (23.0%)</td>
<td>2.30 (1.46, 3.63)</td>
<td>1.96 (1.33, 2.91)</td>
</tr>
<tr>
<td>Rhinorrhea</td>
<td>308 (24.4%)</td>
<td>1.49 (0.99, 2.25)</td>
<td>1.37 (0.98, 1.92)</td>
</tr>
<tr>
<td>Difficulty breathing/dyspnea</td>
<td>120 (9.5%)</td>
<td>2.51 (1.15, 5.47)</td>
<td>2.37 (1.12, 4.99)</td>
</tr>
<tr>
<td>Cough</td>
<td>622 (49.4%)</td>
<td>2.71 (1.90, 3.87)</td>
<td>1.87 (1.45, 2.41)</td>
</tr>
<tr>
<td>Sore throat</td>
<td>386 (30.6%)</td>
<td>0.80 (0.57, 1.11)</td>
<td>0.86 (0.69, 1.07)</td>
</tr>
<tr>
<td>Asymptomatic</td>
<td>175 (13.9%)</td>
<td>0.36 (0.25, 0.51)</td>
<td>0.45 (0.34, 0.58)</td>
</tr>
</tbody>
</table>
The figure above (from McAlister et al, preliminary, via personal communication) shows the PLR across groups by documented symptoms.

Symptoms most associated with a positive RT-PCR test in HCWs across jurisdictions vary in their strength of associations (Chou et al., 2020; Magnavita, Tripepi & Prinzio, 2020; Mandić-Rajčević et al., 2020) but have a common theme of anosmia/ageusia, and fever as well. A small number of international studies available with HCWs data had similar findings amongst the commonly associated symptoms (Lombardi et al., 2020, Magnavita et al., 2020). A cross-sectional study of 595 HCW in Italy tested for COVID-19 (n= 82 PCR+) gathered symptoms via self-report questionnaire. The multivariate adjusted odds ratios (OR) for the symptoms reported as presented in the table 5 of Magnavita et al (2020). Adjusting for socio-demographics, occupational stress, perceived procedural justice and sleep problems (Model III), the symptoms associated the greatest odds of infection were anosmia (OR: 100.7; 95%CI: 26.5,382.6), dysgeusia (OR: 51.8; 95%CI: 16.6,161.9) and fever (OR: 20.3; 95%CI: 7.7,53.4). Breathlessness, exhaustion, and muscle pain also had OR >15. The width of the CI should be noted. Similarly, Lombardi et al. (2020) reported smell and taste alteration as well as fever had the highest multivariate OR (taste/smell OR: 51.4, 95%CI: 17.6, 150; fever OR: 9.12, 95%CI: 5.61,14.8).
Adjusting for sex, age and body mass index, loss of smell (anosmia) and taste (ageusia) were significantly associated with a positive PCR compared to those PCR negative in both UK data (total n= 15,368 [42.0% PCR positive], AOR: 6.40, 95%CI: 5.96, 6.87, \( P < .0001 \)) and US data (total n=2,763 [26.3% PCR positive], AOR: 10.01, 95%CI: 8.23, 12.16, \( p < .0001 \)) (Menni et al., 2020). From the same UK dataset, a linear prediction model for symptoms of COVID-19 was tested and included anosmia, ageusia, loss of appetite, fatigue and persistent cough. Model performance in the UK data (test) was: Sensitivity 0.65 (CI: 0.62, 0.67); Specificity 0.78 (CI: 0.76, 0.80); area under the curve (AUC) of the receiver operating characteristic curve (ROC) 0.76 (0.74, 0.78); PPV 0.69 (0.66, 0.71); NPV 0.75 (0.73, 0.77). Model performance in the US data (validation) was: Sensitivity 0.66 (0.62, 0.69), Specificity 0.83 (0.82, 0.85), AUC 0.76 (0.74, 0.78), PPV 0.58 (0.55, 0.62); NPV 0.87 (0.86, 0.89), suggesting the model is good at identifying true negatives but not true positives. Notably, limitations include a sample not representative of the general population, selection bias, recall bias and inability to determine timing of onset of anosmia (pre-COVID symptoms, during COVID symptoms, during the illness of after).

With respect to associations between symptoms and seroprevalence, data from 2,149 HCWs in Sweden (19.1% seropositive) suggests that the strongest associations with seroprevalence are anosmia (OR 28.4; 95% CI 20.6–39.5), ageusia (OR 19.2; 95% CI 14.3–26.1) and fever (OR 6.3; 95% CI 4.9–8.0), with an odds ratio for the triad of symptoms being 18.6 (95%CI: 12.9, 27.2; positive predictive value [PPV]: 0.75, negative predictive value [NPV]: 0.86). Combing ageusia and/ or anosmia resulted in the highest predictive value (OR: 21.9, 95%CI: 16.5, 29.3; PPV 0.70, NPV 0.905). With respect to exposure, findings suggest the most statistically significant association with seroprevalence was comparing HCWs exposed to COVID-19 patients to HCWs exposed to non-COVID-19 patients (OR: 1.4, 95% CI 1.1, 1.8). Notably, details on inclusion criteria for HCWs was not provided so bias in the sampling is unclear.

**TIME FROM LAST EXPOSURE TO SYMPTOM ONSET IN INFECTED PERSONS**

It is important to begin to understand the typical time between HCW exposure to symptom onset. In general, incubation periods have been estimated to be between 1-14 days (PHAC, 2020). The literature specific to HCWs was very limited and was supplemented by hand searching reference lists and studies that report on the interval between exposure and symptom onset in general populations (Table 3). With respect to occupationally exposed HCWs, a prospective cohort study of HCWs with a history of occupational exposure and evaluate a 7-day quarantine policy following high risk exposures and a 14-day monitoring program regardless of risk level to identify onset of any symptoms (Maltezou et al., 2020). 755 HCW developed ≥1 symptom (22.2%) out of the 3,398 exposed HCWs (cause of symptoms was not described in those not COVID-19 positive). 454 HCWs from the symptomatic group (60.1%) were tested by RT-PCR, of which 66 tested positive for COVID-19 (14.5%). Of the 66 COVID-19 positive HCWs, 52 were high risk exposures (no or missing appropriate PPE). High risk exposures accounted for 1,031 of all exposed HCWs, of which 588 high risk were tested and 218 were
symptomatic. The mean incubation period was 3.65 ± 3.31 days with only one case developing symptoms beyond 14 days. Overall, 90.9% of the confirmed cases developed symptoms by day 7. These findings are supportive of a 7-day quarantine period for high-risk exposures, as well as a 14-day self-monitoring period regardless of risk level. A case series in the US, following HCW exposure to a confirmed COVID-19 patient who was transferred from Hospital A to Hospital B, Hospital A reported 121 HCWs with exposure history and found 35.5% (n=43) developed symptoms. High and moderate risk exposures were quarantined for 7 days whereas HCWs with low risk exposures were allowed to continue to work with daily monitoring of symptoms for 14 days since last exposure (no details provided on PPE requirements for HCWs with low risk exposures working during the monitoring period). PCR testing was performed following symptoms onset (median 10 days between exposure and PCR test). Three HCWs (7%) tested positive and all three cases were high risk exposures (risk definition in Table 2), two of which reported not wearing a mask during frequent exposure to the index case including BiPAP and intubation (Heinzerling et al., 2020). Hospital B reported a total of 146 HCWs exposed to the index patient following interfacility transfer, of which eight became symptomatic and none of whom tested positive for COVID-19 (Heinzerling et al., 2020).

With respect to data from community-based studies (with or without inclusion of HCWs data), most of the identified studies reported the interval from exposure until the first symptom (any) was experience, see time to symptom figure presented below from Lauer et al (2020). This group also analyzed data by the onset of a fever (to control for coughs and sore throats as potentially being due to non COVID illness). The estimated median incubation period until fever onset (n=99) was 5.7 days (95% CI: 4.9, 6.8). In 97.5% of cases, fever symptoms will display within 12.5 days (95% CI: 8.2, 17.7), while 2.5% of cases will display fever symptoms within 2.6 days (95% CI: 2.1, 3.7) (Lauer et al, 2020). A systematic review and meta-analysis (McAloon et al., 2020) of studies that looked at incubation periods (including Lauer et al.) reported a random-effects pooled incubation period of 5.1d (4.53, 5.75) from exposure to symptom onset (any), with 75% of cases exhibiting symptoms by day 7.15 (95%CI: 6.13, 8.34), 90% of cases showing symptoms by day 9.69 (95%CI: 8.06, 11.6) and 95% showing symptoms by day 11.6 (95%CI: 9.49, 14.2). Notably, the meta-analysis is limited by the exclusion of raw data, independent analysis of lognormal distributions and external validity of study biases.

Research Question • 19


Table 3. Evidence summary: incubation period and symptom development

<table>
<thead>
<tr>
<th>Reference/ Source</th>
<th>Cases n</th>
<th>Symptom(s)</th>
<th>Time from Exposure to Symptom Onset Median (95%CI)</th>
<th>Proportion of Exposed Symptomatic by day(s) Median (95%CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>McAloon C, Collins A, Hunt K, et al. Incubation period of COVID-19: a rapid rapid</td>
<td></td>
<td>All Symptoms</td>
<td>5.1d (4.53, 5.75)</td>
<td>2.5% by 1.92d (1.54, 2.38)</td>
</tr>
<tr>
<td>systematic review and meta-analysis of observational research. BMJ Open</td>
<td>181</td>
<td></td>
<td></td>
<td>75% by 7.15d (6.13, 8.34)</td>
</tr>
<tr>
<td>2020;10:e039652, doi:10.1136/bmjopen-2020-039652.</td>
<td></td>
<td></td>
<td></td>
<td>90% by 9.69d (8.06, 11.6)</td>
</tr>
<tr>
<td><a href="https://bmjopen.bmj.com/content/bmjopen/10/8/e039652.full.pdf">https://bmjopen.bmj.com/content/bmjopen/10/8/e039652.full.pdf</a></td>
<td></td>
<td></td>
<td></td>
<td>95% by 11.6d (9.49, 14.20)</td>
</tr>
<tr>
<td><strong>Meta-analysis includes:</strong></td>
<td></td>
<td></td>
<td></td>
<td>97.5% by 13.6d (10.9, 16.9)</td>
</tr>
<tr>
<td>Lauer et al., 2020</td>
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<tr>
<td>Jiang et al., 2020</td>
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<td>Li et al., 2020</td>
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<td>Linton et al., 2020</td>
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<td>Ma et al., 2020</td>
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<tr>
<td>Bi et al., 2020</td>
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<tr>
<td>Zhang et al., 2020b</td>
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<tr>
<td>Leung, 2020</td>
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<tr>
<td>Lauer SA, Grantz KH, Bi Q, Jones FK, Zheng Q, Meredith HR, Azman AS, Reich NG,</td>
<td>181</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Lessler J. The incubation period of coronavirus disease 2019 (COVID-19) from</td>
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<tr>
<td>publicly reported confirmed cases: estimation and application. Annals of internal</td>
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<td>medicine. 2020 May 5;172(9):577-82.</td>
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<tr>
<td>184</td>
<td></td>
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<td></td>
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<tr>
<td>All Symptoms</td>
<td>181</td>
<td></td>
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<tr>
<td>Fever</td>
<td>5.7d (4.9 - 8.8)</td>
<td>&lt;2.5% by 2.2d (1.8, 2.9)</td>
<td>97.5% by 11.5d (8.2, 15.6)</td>
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<tr>
<td>2.5% by 2.6d (2.1, 3.7)</td>
<td></td>
<td></td>
<td></td>
<td>97.5% by 12.5d (8.2, 17.7)</td>
</tr>
<tr>
<td>optimal for effectively controlling coronavirus disease 2019 (COVID-19)? medRxiv</td>
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<td></td>
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<tr>
<td>preprint. 18Mar2020 doi:</td>
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<tr>
<td><a href="https://doi.org/10.1101/2020.03.15.20036533">https://doi.org/10.1101/2020.03.15.20036533</a>.</td>
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<tr>
<td>Pre-print</td>
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<tr>
<td>Total: 2015</td>
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<tr>
<td>Adult: 1,916</td>
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<tr>
<td>Child: 99</td>
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<tr>
<td>All symptoms</td>
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<tr>
<td>Adults: 7d</td>
<td></td>
<td></td>
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<tr>
<td>Children: 9d</td>
<td></td>
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</tr>
<tr>
<td>Men:</td>
<td></td>
<td></td>
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<tr>
<td>94.8% by 17-18d</td>
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<tr>
<td>98.7% by 21d</td>
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<tr>
<td>Women:</td>
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<tr>
<td>96.2% by 17-18d</td>
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<tr>
<td>97.9% by 21d</td>
<td></td>
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</tr>
<tr>
<td>Study</td>
<td>Excluding Wuhan residents:</td>
<td>Including Wuhan residents:</td>
<td>Mean</td>
<td>95% by</td>
</tr>
<tr>
<td>----------------------------------------------------------------------</td>
<td>-----------------------------</td>
<td>-----------------------------</td>
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<td>----------------</td>
</tr>
<tr>
<td>Ma S, Zhang J, Zeng M, Yun Q, Guo W, Zheng Y, et al. Epidemiological parameters of coronavirus disease 2019: a pooled analysis of publicly reported individual data of 1155 cases from seven countries. <a href="https://doi.org/10.1011/2020.03.21.20040329">https://doi.org/10.1011/2020.03.21.20040329</a></td>
<td>587</td>
<td>any symptoms</td>
<td>2.5% by 1d</td>
<td>97.5% by 17d</td>
</tr>
<tr>
<td>Bi Q, Wu Y, Mei S, et al. Epidemiology and transmission of COVID-19 in Shenzhen China: analysis of 391 cases and 1,286 of their close contacts. medRxiv 2020 <a href="https://www.medrxiv.org/content/medrxiv/early/2020/03/19/2020.03.03.20028423.full.pdf">https://www.medrxiv.org/content/medrxiv/early/2020/03/19/2020.03.03.20028423.full.pdf</a></td>
<td>Total: 391</td>
<td>All symptoms</td>
<td>4.8d (4.2, 5.4)</td>
<td>14.0d (12.2, 15.9)</td>
</tr>
<tr>
<td>Mean Non-travelers: 7.2d (6.1, 8.4)</td>
<td>Non-travelers: 7.2d (6.1, 8.4)</td>
<td>Mean Non-travelers: 7.2d (6.1, 8.4)</td>
<td>Mean Non-travelers: 7.2d (6.1, 8.4)</td>
<td>14.6d (12.1, 17.1)</td>
</tr>
<tr>
<td>Backer JA, Klinkenberg D, Wallinga J. Incubation period of 2019 novel coronavirus (2019-nCoV) infections among travellers from 88</td>
<td>All symptoms</td>
<td>Mean: 6.4d (5.6, 7.7)</td>
<td>2.5% by 11.1d</td>
<td>97.5% by 11.1d</td>
</tr>
</tbody>
</table>


Alberta Data (WHS)

With respect to Alberta, Table 4 presents data from Workplace Health and Safety on occupational exposure to symptom onset in 62 HCWs, of which 59 were symptomatic and 3 were asymptomatic (4 asymptomatic included in dataset, 1 was excluded with no exposure dates). Among symptomatic cases with a date of first exposure (n=53), the median number of days since first exposure to symptom onset was 5 days (75% by day 8, 90% by day 12 and 95% by day 14). Median time from last exposure to symptom onset (n=53) was 4 days (75% by day 5, 90% by day 8 and 95% by day 10). For symptomatic cases, median time was 9 days from first exposure to a positive test result (75% by day 12, 95% by day 20) and a median of 7 days from last exposure to first positive test (75% by day 10, 95% by day 14). For the asymptomatic cases, 2 case had first and last exposure on the same day (1 case 4 days between exposure to positive test, 1 case experienced 11 days between exposure to positive test). The third asymptomatic case only had date of first exposure and a positive test occurred 11 days later.

Table 4. Distribution of #days from first or last exposure to symptom onset or test result

<table>
<thead>
<tr>
<th>Number of days from</th>
<th>N</th>
<th>Mean</th>
<th>SD</th>
<th>Median</th>
<th>p25%</th>
<th>p75%</th>
<th>p90%</th>
<th>p95%</th>
</tr>
</thead>
<tbody>
<tr>
<td>All cases</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>First exposure to symptom onset</td>
<td>53</td>
<td>7</td>
<td>4</td>
<td>5</td>
<td>4</td>
<td>8</td>
<td>12</td>
<td>14</td>
</tr>
<tr>
<td>Last exposure to symptom onset</td>
<td>53</td>
<td>4</td>
<td>3</td>
<td>4</td>
<td>2</td>
<td>5</td>
<td>8</td>
<td>10</td>
</tr>
<tr>
<td>First exposure to test result</td>
<td>57</td>
<td>10</td>
<td>5</td>
<td>9</td>
<td>7</td>
<td>12</td>
<td>16</td>
<td>20</td>
</tr>
<tr>
<td>Last exposure to test result</td>
<td>56</td>
<td>8</td>
<td>3</td>
<td>7</td>
<td>6</td>
<td>10</td>
<td>12</td>
<td>13</td>
</tr>
<tr>
<td>Asymptomatic cases</td>
<td></td>
<td></td>
<td></td>
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<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>First exposure to test result</td>
<td>3</td>
<td>9</td>
<td>4</td>
<td>11</td>
<td>4</td>
<td>11</td>
<td>11</td>
<td>11</td>
</tr>
<tr>
<td>Last exposure to test result</td>
<td>2</td>
<td>8</td>
<td>5</td>
<td>8</td>
<td>4</td>
<td>11</td>
<td>11</td>
<td>11</td>
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<tr>
<td>Symptomatic cases</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>First exposure to test result</td>
<td>54</td>
<td>10</td>
<td>5</td>
<td>9</td>
<td>7</td>
<td>12</td>
<td>16</td>
<td>20</td>
</tr>
<tr>
<td>Last exposure to test result</td>
<td>54</td>
<td>8</td>
<td>3</td>
<td>7</td>
<td>6</td>
<td>10</td>
<td>12</td>
<td>13</td>
</tr>
</tbody>
</table>

* N, number of HCWs; p, percentile; SD, standard deviation.
The cumulative proportions of cases and 95% binomial confidence intervals by time duration (in days) from the dates of the first/last exposure to the dates of symptom onset/test results are shown in Table 5.

**Table 5. Cumulative proportions of cases and 95%CI by time duration in days from the dates of the first/last exposure to the dates of symptom onset/test results**

<table>
<thead>
<tr>
<th>Time</th>
<th>First exposure to symptom onset</th>
<th>Last exposure to symptom onset</th>
<th>First exposure to test result</th>
<th>Last exposure to test result</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean Low High</td>
<td>Mean Low High</td>
<td>Mean Low High</td>
<td>Mean Low High</td>
</tr>
<tr>
<td>&lt;=5 days</td>
<td>52.8% 38.6% 66.7%</td>
<td>75.5% 61.7% 86.2%</td>
<td>7.0% 1.9% 17.0%</td>
<td>25.0% 14.4% 38.4%</td>
</tr>
<tr>
<td>&lt;=7 days</td>
<td>69.8% 55.7% 81.7%</td>
<td>84.9% 72.4% 93.3%</td>
<td>35.1% 22.9% 48.9%</td>
<td>55.4% 41.5% 68.7%</td>
</tr>
<tr>
<td>&lt;=10 days</td>
<td>86.8% 74.7% 94.5%</td>
<td>98.1% 89.9% 100%</td>
<td>57.9% 44.1% 70.9%</td>
<td>80.4% 67.6% 89.8%</td>
</tr>
<tr>
<td>&lt;=14 days</td>
<td>96.2% 87.0% 99.5%</td>
<td>100.0% 93.3% 100%*</td>
<td>84.2% 72.1% 92.5%</td>
<td>96.4% 87.7% 99.6%</td>
</tr>
<tr>
<td>&lt;=21 days</td>
<td>100.0% 93.3% 100%*</td>
<td></td>
<td>96.5% 87.9% 99.6%</td>
<td>100.0% 93.6% 100%*</td>
</tr>
<tr>
<td>&lt;=25 days</td>
<td></td>
<td></td>
<td>100.0% 93.7% 100%*</td>
<td></td>
</tr>
</tbody>
</table>

*one-sided, 97.5% confidence interval.

Comparing the sample of Alberta HCW data to a community-based sample from Luo et al. (2020) described previously, time to symptom onset from last exposure was slightly longer for those cases developing symptoms in the first 7 days; however, increases above the community-based data from day 8.

**Table 6. Cumulative proportions of cases by days between last exposure to symptom onset, comparing community-based study data and WHS HCW data**

<table>
<thead>
<tr>
<th>Days from last exposure</th>
<th>Cumulative % of cases from last exposure to symptom onset (Luo et al., 2020)</th>
<th>Cumulative % of cases from last exposure to symptom onset AHS WHS Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;=5 days</td>
<td>88%</td>
<td>75.5%</td>
</tr>
<tr>
<td>&lt;=7 days</td>
<td>90.5% *(from McAloon et al meta-analysis)</td>
<td>84.9%</td>
</tr>
<tr>
<td>&lt;=10 days</td>
<td>94.9 *(from McAloon et al meta-analysis)</td>
<td>98.1%</td>
</tr>
<tr>
<td>&lt;=14 days</td>
<td>98.9%</td>
<td>100%</td>
</tr>
<tr>
<td>&gt;14 days</td>
<td>100%</td>
<td></td>
</tr>
</tbody>
</table>

**SUMMARY: Subquestion 2**

There are no standardized HCW risk classifications but identified studies have begun to develop classification systems which are often based on contact assessment, however, definitions across studies are heterogeneous and there is little to no validation of such definitions. Two studies examining the association between level of exposure risk and infection suggest that high risk exposures are significantly associated with a positive PCR (Maltezou et al., 2020) and for both high and low risk exposures, a higher infection rate was associated with symptomatic HCWs over asymptomatic HCWs at the time of testing. (Kaur et al., 2020). With respect to source patient factors, Luo et al. (2020) reported a positive association between infection rate and severity of the index case in a community study but notably these was an inferential finding of this study. Future efforts to construct validation risk definitions and high-quality evidence to quantify the relationship between level of exposure risk and transmission would support decision makers to align evidence-based definitions to the local context.

Epidemiologic transmission data suggest most transmission occurs within 5 days of symptom onset, with other data suggesting high levels of virus are present from 2 days prior to symptom onset (Cheng H-Y et al, 2020). Lack
of transmission after day 5 may be relevant in the dynamics of healthcare-based outbreaks and supports strategies that reduce that risk. PPE use and distance are important mitigating factors to reducing transmission (see SAG Asymptomatic Review), though no studies directly exploring PPE use in mitigating transmission from HCWs following a significant exposure event were identified in this review.

Reports of the association between given symptoms and a positive test vary across studies in the sense of magnitude. Early data from CDOM in Alberta suggest symptoms of anosmia, ageusia and fever/fevered chills are most commonly associated with a positive PCR test in HCWs, which aligns with findings in the literature (Lombardi et al., 2020, Magnavita et al., 2020, Menni et al., 2020). While there are some variations across studies on the time between last exposure to symptom onset, community-based data most often suggests the incubation period to be around day 5 after last exposure (Lauer et al., 2020; Linton et al., 2020; McAloon et al., 2020) and Alberta WHS data for HCWs suggests the median incubation period to be 4 days (75% by day 5) in a small sample of 53 exposed HCWs. Comparing the sample of Alberta HCW data to a community-based sample from Luo et al. (2020) described previously, time to symptom onset from last exposure was slightly longer for those cases developing symptoms in the first 7 days; however, increases above the community-based data from day 8.

It should be noted that incubation period was presented as either mean or median across studies, which makes direct comparison complicated. As this review identified mostly lower quality studies, findings should be interpreted within the context of study limitations.

**Subquestion 3: What is the optimal timing and frequency of post exposure testing in order to detect early infection and reduce the risk of occupational transmission to others if shortening the post-exposure quarantine period?**

**OPTIMAL TIMING AND FREQUENCY OF POST-EXPOSURE TESTING**

As alluded to above, test performance is an important consideration if considering test as an adjunct to clinical monitoring around quarantine end. RT-PCR tests used to detect SARS-CoV-2 are point-in-time measures which can provide false reassurance to those testing negative in whom the viral load for SARS-CoV-2 is pre-detectable or incorrectly classified (false negative). As such, understanding evidence on the optimal timing and frequency that RT-PCR tests should be conducted can guide design of a monitoring program to reduce the risk of HCW returning to work while with infectious SARS-CoV-2. A literature review and pooled analysis (n=7 community data studies) was used to create a Bayesian hierarchical model (logistic regression) to estimate the false-negative rate, by day, of RT-PCR tests for SARS-CoV-2 (Kucirka et al., 2020). Cases were defined as at least 1 positive RT-PCR result and exposure was assumed to have occurred 5 days prior to symptom onset, consistent with the interval found in other studies in this review (Lauer et al., 2020; Luo et al., 2020). Post-test probability was calculated based on a pre-test probability of an attack rate of 11.2% obtained from the household transmission literature. This review found that the false-negative rate on the day of symptom onset was 38% (95%CI: 18%, 65%), which dropped to its lowest at 20% on day 8 (95%CI: 12%, 30%) which is 3d following typical symptom onset within this dataset. After which, the false-negative rate rises again, from d9 (21%; 95%CI: 13%, 31%) and reaching 66% on day 21 (95%CI: 54%, 77%). A sensitivity analysis of the relationship between posttest probability of negative PCR based on pretest probability (likelihood of infection based on exposure magnitude or clinical presentation) suggests that negative posttest probability is minimized by day 8 post-exposure for both high pretest probability (i.e., using 4X attack rate of 11% [44%], day 8 posttest probability lowest at 14% [CI: 9, 20]) and low pretest probability (i.e., using 50% of observed attack rate [5.5%], day 8 posttest probability of 1.2% [CI: 0.7, 2.0]). This data suggests that for symptomatic persons, testing 2-3 days following symptom onset would appear to minimize the likelihood of false-negative tests. Notably, there is considerable uncertainty in these numbers as per the authors and does not account for multiple potential exposures.

Similarly, Zhang et al (2020a) reported that among PCR- close contacts RT-PCR missed 36% of infections (95%CI: 28%,44%) when assessed RT-PCR surveillance protocol performance and undetected transmission in Shenzhen, China. Applying a best-fit polynomial spline model to estimate the variability of PCR false-negative rates over the course of infection, the probability of false-negative PCR test on the day of symptom onset to be 34% (95%CI: 21%,51%), with the lowest probability 4d following symptom onset (11%, 95%CI: 5%,21%).

The very limited evidence included above suggests that overall, the optimal timing of testing appears to fall between 3-4 days post-symptom onset, with the lowest rate of false negatives among infected case occurring day 8 after the last exposure. Routine and repeated testing, specifically in asymptomatic populations, may be of limited value during times of low COVID-19 prevalence; however, increased testing irrespective of symptoms may benefit during high prevalence instances such as a hospital outbreak (Brown et al., 2020). A second search strategy targeted specifically to this question and without restrictions to HCW may return additional evidence to provide guidance on this sub-question; however, it could be anticipated that many studies would be based on single exposure experiences whereas the reality for HCWs is ongoing potential exposures, adding complexity to deriving an optimal interval for this population. Notably, these findings are derived from community based data, much of which occurred early in the pandemic with early case definitions for COVID-19; no data specific to such rates in HCW populations was found during the period of this rapid review. High quality local data collection should assist in ongoing refinement of these processes. Data fields that appear useful from the literature review include first and last day of exposure, whether the exposure was in a setting of known transmission from that source or a high intensity unit outbreak, PPE use, duration, distance, and time of collection, and time of results of PCR tests. In addition, a symptom questionnaire including documentation of symptoms, indicating which were initial symptoms and which were dominant symptoms would potentially help refine the risk screening questionnaire.

Subquestion 4: What HCW quarantine guidelines do other jurisdictions use following an exposure?

A grey literature search was conducted to find HCW quarantine guidelines from other jurisdictions to explore the quarantine/self-isolation periods implemented. Supplementary Table I contains a sample of jurisdictional guidelines used elsewhere in Canada and internationally to address quarantine periods for HCW following an exposure. Periods of quarantine commonly reported vary but most are 14 days (European CDC, 2020; HSE, 2020; Public Health England, 2020; WHO, 2020), and some are 10 days (National Institute for Health and Environment, 2020; Swissnoso, 2020).

British Columbia’s Centre for Disease Control (CDC) guidelines use a decision tree approach that accounts for PPE level, exposure scenario, risk level and implementation of recommended measures. For recommendations based on risk-criteria, all HCW developing symptoms are excluded from work and self-isolate until symptoms resolve or 10d from symptom onset (whichever is longer). For asymptomatic HCW with a high-risk exposure are suggested to self-isolate for 14 days if non-essential; however, essential asymptomatic HCWs may continue to
work without a quarantine period and must follow IPC measures (always masked, maintain appropriate physical distance) and self-monitor for symptoms for 14 days.

The US CDC (2020a) guidelines indicate that HCWs should self-isolate following a high-risk exposure for 14 days; however, those with lower exposure risks do not have work restrictions as long as asymptomatic and provided they follow IPC guidelines including continuous masking and self-monitoring daily and before each shift for 14 days following last exposure. The US CDC (2020b) also provides guidelines for non-US healthcare settings around managing exposures in HCWs states that those with a high-risk exposure should be restricted from work for 14 days whether symptomatic or asymptomatic and HCWs who are asymptomatic following a low risk exposure should self-monitor for 14-days whether symptomatic or asymptomatic; however, HCWs with low risk exposures and deemed ‘essential’ may continue to work during the 14-days post-exposure but must self-monitor twice a day for 14 days and would preferably only provide care to COVID-19 patients.

RISK MITIGATION FOR HCWs RETURNING TO WORK EARLIER THAN 14 DAYS
There are ongoing concerns around health system capacity and staffing shortages as confirmed cases of COVID-19 are on the rise. This begs the question, for those HCWs with low risk exposure that remain asymptomatic at day 10 and have a negative PCR test on day 8 post-exposure, what risk mitigation strategies should be put in place to allow early return to work to reduce capacity strain. The jurisdictional review of guidelines also identified those jurisdictions with any criteria for early return to work (whether confirmed positive by PCR or not). Several jurisdictions have begun to include guidance on staffing shortages as additional considerations to managing HCWs and workflow during the pandemic.

The WHO (2020) guidelines for HCWs with high risk exposures must quarantine for 14 days; however, those with low risk exposures states that HCWs must self-monitor for 14 days (no isolation required) after last exposure and notify the healthcare facility if symptoms develop; however, may continue to work as long as the below criteria are followed:

- reinforce contact and droplet precautions when caring for all patients with acute respiratory illness and standard precautions for all patients
- reinforce airborne precautions for aerosol procedures on suspected or confirmed cases
- reinforce the rational, correct, and consistent use of personal protective equipment
- adherence to good hand hygiene
- practice respiratory etiquette

The state-level guidelines from the Minnesota Department of Health (2020) go one step further and provide recommendations on HCWs with high risk exposures continuing to work in the 14 days following exposure. Notably, the guidelines do NOT require mandatory isolation following exposure and suggest HCWs work from home ‘if possible’. For those returning to work (not isolating), HCWs should take on roles that do not involve direct patient care (e.g., phone triage, telemedicine). If such roles are not feasible the following recommendations are provided for the 14-day period post-exposure:

- Avoid providing care to those patients identified as high risk for adverse outcomes (e.g., immunocompromised, elderly, presence of comorbidities)
- Always wear a surgical mask and adhere to good hand hygiene practices
- Self-monitor for onset of symptoms and measure body temperature daily

If the HCW develops symptoms they must notify their supervisor in case medical attention is required. In cases where fever or respiratory symptoms develop, HCWs are no longer permitted to work and must notify their unit. If such symptoms develop during a shift, HCWs are to notify their supervisor immediately and return home after notifying their supervisor.

Using Ontario Ministry of Health (2020) as a Canadian example, asymptomatic HCWs with low risk exposure (<2m distance with appropriate PPE/ continuous masking during co-worker interactions) that are awaiting testing results may continue to work and must follow the facilities recommended precautions. With respect to staffing concerns, the additional two scenarios are recommended. First, asymptomatic HCWs with a high-risk exposure
may return to work early from self-isolation and return to work. Second, in exceptionally rare circumstances around staffing shortages compromising clinical care, asymptomatic HCWs confirmed to be positive may return to work early, recognizing they may still be infectious. While on self-isolation, HCWs should only work in one location and ideally COVID-19 positive HCWs would be coholed to COVID-19 units/ provide care for COVID-19 patients or residents. Both exceptions require the HCW to adher to ‘work self-isolation’ measures:

- At work: adhere to universal masking recommendations, good hand hygiene, physically distance (>2m) at all times except while providing care to patients/residents
- Outside of work: must self-isolate outside of work for 14 days from last high-risk exposure or 10 days from a negative PCR sample is still asymptomatic

Similarly, the US CDC (2020c) recommends that HCWs with exposure that are not known to have COVID-19 and remain asymptomatic may return to work to mitigate staffing shortages provided they: continuously mask for 14 days following exposure, report daily to the unit on body temperature and confirm still asymptomatic and undergo testing for COVID-19 within 14 days following last exposure if testing is readily available. Onset of any symptoms associated with COVID-19 can no longer work, no matter of how mild the symptoms. With respect to HCWs with confirmed COVID-19, CDC (2020d) recommends a symptom-based strategy to address early return to work. An asymptomatic HCW may return to work 10 days after testing positive if they are not severely immunocompromised and are able and willing to work. HCWs with confirmed COVID-19 who are not severely immunocompromised and have mild to moderate illness may return to work 10 days following symptom onset.

**SUMMARY:** Subquestion 4

When faced with a limited evidence base without high-quality studies, looking to the guidance and recommendations put forward by other jurisdiction helps to identify commonalities and contrast local guidelines with the trends across jurisdictions. The most common quarantine periods for HCWs across jurisdictions ranged from 10 days to 14 days. Of the 18 guidelines included in Supplementary Table 1 almost all include considerations or recommendations that vary between low risk and high risk exposures (often defined to include no or inadequate PPE use), suggesting that exposure risk level is widely considered to be relevant to evaluating the risk of HCWs returning to work following a significant exposure. An unfortunate yet not uncommon situation is that such guidelines do not reveal the evidence sourced used in their development.

Risk mitigation strategies to reduce transmission risk associated with HCWs returning to work following a significant exposure, whether it be guidelines focused on quarantine periods or mitigating staffing shortages, most often include physical distancing, continuous masking, appropriate PPE use and adherence to good hand hygiene practices. Some jurisdictions also recommend that HCWs returning to work following an exposure should not provide care for clinically complex and/or immunocompromised patients; however, in practice this is likely to challenging to operationalization as a standard owing to the sheer variations across healthcare facilities, staffing levels and patient populations. Not surprisingly, early return to work is commonly considered for those HCWs with lower exposure risk and/or asymptomatic (compared to high risk exposures and presence of symptoms).

As the COVID-19 pandemic evolves, so do the need for the release of new or revised guidelines to optimally match the current state of the evidence. Monitoring the effects of changes to recommendations across jurisdictions may support the iterative development of local guidelines. Local data collection should be encouraged to collect data of HCW infection rates in the context of their exposure and risk assessment, and duration of quarantine to assess the adequacy of current recommendations, and the effectiveness of applied mitigation strategies to reduce risk of transmission from HCWs returning to work after quarantine.
Evolving Evidence
The evidence for these research questions is rapidly evolving. This review will be updated as new data from additional evidence is available. It will be important to be able to assess the quality of new studies as they become available, including a critical examination of the study assumptions, statistical approaches and limitations.

<table>
<thead>
<tr>
<th>Date question received by advisory group: September 25, 2020</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date report submitted to committee: October 21, 2020</td>
</tr>
<tr>
<td>Date of first assessment: November 3, 2020</td>
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<tr>
<td>(If applicable) Date of re-assessment:</td>
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</table>

Authorship and Committee Members
This report was written by Jamie Boyd and Lynora Saxinger (co-writer) with assistance from Ashley Fraser, Marysia Stasiewicz and Amanda Davis. It was scientifically reviewed by Lynora Saxinger (co-chair), Uma Chandran, Robyn Harrison, Oscar Larios, Stephen Tsekrekos, and David Zygun. The full Scientific Advisory Group was involved in discussion and revisions of the document: Braden Manns (co-chair), Lynora Saxinger (co-chair, primary reviewer), John Conly, Alexander Doroshenko, Shelley Duggan, Nelson Lee, Elizabeth MacKay, Andrew McRae, Melissa Potestio, James Talbot, Jeremy Slobodan, Brandie Walker, and Nathan Zelyas.

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<table>
<thead>
<tr>
<th>Reference</th>
<th>Setting</th>
<th>Definition of Exposure</th>
<th>Quarantine/isolation requirements following exposure (and/or positive test)</th>
<th>Criteria for Return to Work</th>
</tr>
</thead>
</table>
| Ministry of Health, Ontario, Version 10 | Healthcare workers | ‘This information can be used to help guide decision making on testing and clearance of contacts of cases or individuals suspected or confirmed to have COVID-19’ | • Contacts who have had a high-risk exposure to a case must self-isolate for 14 days from their last exposure.  
• ‘In a symptomatic patient currently within their 14-day self-isolation as a result of a known exposure, a single negative result is sufficient to exclude COVID-19 at that point in time. However, the individual should remain in self-isolation for the remainder of their 14-day period, and if symptoms change or worsen, repeat testing.’  
• For ‘asymptomatic individuals who has been advised by local public health to get tested due to exposure to a case or as part of an outbreak investigation should be tested within 14 days from their last exposure. A single negative result is sufficient to exclude COVID-19 at that point in time. However, the individual must continue to follow public health advice provided to them based on their exposure risk for the rest of their 14 days from last unprotected exposure to the case, regardless of the negative result as they may still be incubating.’  
• ‘Note, the above was not specific to HCW’ | • ‘HCWs should follow isolation and clearance with a non-test based approach; if they have required hospitalization during the course of their illness, a test based approach may be used at the discretion of the hospital while they are admitted.  
• Symptomatic HCWs awaiting testing results must be off work  
• Asymptomatic HCWs awaiting testing results may continue to work using the appropriate precautions recommended by the facility, which will depend on the reason for testing (i.e., asymptomatic HCW is not on self-isolation following a high-risk exposure)  
• In exceptional circumstances where clinical care would be severely compromised without additional staffing, an earlier return to work under work self-isolation may be considered for an asymptomatic HCW who is self-isolating due to a high-risk exposure.  
• ‘Note, the above does not always distinguish between positive case or exposure.’ |
| Ministry of Health, Ontario, Version 9.1 | Healthcare (including all locations where health care is provided, e.g., community, acute care, long-term care) | HCW is the case:  
Low-Risk Exposure  
- All patients for whom the HCW provided direct care, or who had other similar close physical contact (i.e., patient was < 2 meters away from HCW for any duration of time), when the HCW was wearing a surgical/procedure mask  
- All co-workers who had close prolonged contact1 with the HCW (e.g., within 2 meters in an enclosed common area | • Low-Risk Exposure: Follow guidance on core public health measures recommended for everyone at all times including: Self-monitoring for symptoms of COVID-19; seeking assessment and testing; and self-isolating if symptoms develop, as per provincial guidance  
• High-Risk Exposure: Self isolate and:  
Do not attend school or work; avoid | *Note. Asymptomatic Cases with a Medium/High Pre-Test Probability defined as: Asymptomatic cases assessed as having a medium/high (i.e., not low) pre-test probability of having current, infectious COVID-19 due to recent infection include, at minimum, case who were tested as a result of an epidemiological link to a known COVID-19 case or a known COVID-19 outbreak, or both |
<table>
<thead>
<tr>
<th><strong>Research Question</strong></th>
<th><strong>Long-term care, HCW</strong></th>
<th><strong>Health Care Workers require an individual assessment, and should not automatically be assumed to be a medium/high pre-test probability</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ontact_mngmt/management_cases_contacts.pdf</strong></td>
<td>when the HCW was wearing a surgical/procedure mask) - Laboratory worker processing COVID-19 specimens from case with appropriate PPE</td>
<td>• *Note, HCWs returning from travel should not attend work if they are sick. If there are particular workers who are deemed critical, by all parties, to continued operations, these workers undergo regular screening, use appropriate Personal Protective Equipment (PPE) for the 14 days and undertake active self-monitoring. This includes taking their temperature twice daily to monitor for fever, and immediately self-isolate if symptoms develop and self-identity to their occupational health and safety department</td>
</tr>
<tr>
<td><strong>High-Risk Exposure</strong></td>
<td>- All patients for whom the HCW provided direct care, or who had other similar close physical contact (i.e., patient was &lt; 2 meters away from HCW for any duration of time), when the HCW was not wearing a surgical/procedure mask</td>
<td></td>
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<tr>
<td><strong>High-Risk Exposure</strong></td>
<td>- All co-workers who had close prolonged unprotected contact with the HCW (e.g., within 2 meters in an enclosed common area when the HCW was not wearing a surgical/procedure mask)</td>
<td></td>
</tr>
<tr>
<td><strong>High-Risk Exposure</strong></td>
<td>- Laboratory worker processing COVID-19 specimens from case without appropriate PPE (including accidental exposures where appropriate PPE was breached).</td>
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<tr>
<td><strong>High-Risk Exposure</strong></td>
<td>*Note, prolonged exposure duration may be defined as lasting more than 15 minutes; however, data are insufficient to precisely define the duration of time that constitutes a prolonged exposure, and exposures of &lt;15 minutes may still be considered high risk exposures depending on the context of the contact/exposure</td>
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<tr>
<td><strong>Low Risk Exposure</strong>:</td>
<td>Close contact with others, including those within your home, as much as possible; follow advice in self-isolation fact sheet; have a supply of procedure/surgical masks available should close contact with others be unavoidable; postpone elective health care until end of monitoring period; use a private vehicle if need to attend a medical appointment; where a private vehicle is not available, private hired vehicle may be used while wearing a procedure/surgical mask and sitting in the rear passenger seat with the window open (weather permitting); do not take public transportation; remain reachable for monitoring by local PHU; discuss any travel plans with local PHU; if symptoms develop, ensure self-isolating immediately, and contact local PHU and health care provider prior to visiting a health care facility</td>
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</table>

Public Health Ontario  
Provincial level, CA  
Date: Aug 13, 2020  

**A. Patient is the case:**  
- **High Risk Exposure:**  
  - HCW and/or support staff who provided care for the case or who had other similar close physical contact without consistent and appropriate use of PPE  
  - Other residents in the same room when the case was not on Droplet and Contact precautions  
  - Other residents in common areas (i.e., < 2 meters from case for any duration of time) when the case was not wearing a surgical/procedure mask  
- **Low Risk Exposure:**  

**B. HCW is the case:**  
- **High Risk Exposure:**  
  - Self-isolate  
- **Low Risk Exposure:**  
  - Self Monitor  
- **HCWs who have had a high-risk exposure** should be in self-isolation. Work self-isolation* may be considered if you are required to work for continuity of operations in the facility.  
  - Work self-isolation occurs if there are particular workers who, by all parties, are deemed critical to sustain continued operations. You should  

**None specified, see isolation guidelines**
HCW and/or support staff who provided direct care for the case or who had other similar close physical contact (i.e., < 2 meters from patient for any duration of time) with consistent and appropriate use of PPE in relation to the care provided

B. HCW is the case:

- **High risk Exposure:**
  - All co-workers who had close prolonged, unprotected contact with the HCW (e.g., within 2 meters in an enclosed common area when the HCW was not wearing a surgical/procedure mask)
  - All residents for whom the HCW provided direct care, or who had other similar close physical contact (i.e., resident was < 2 meters away from HCW for any duration of time), when the HCW was not wearing a surgical/procedure mask
  - Low Risk exposure:
  - All patients for whom the HCW provided direct care or who had other similar close physical contact (i.e., patient was < 2 meters away from HCW for any duration of time), when the HCW was wearing a surgical/procedure mask
  - All co-workers who had close prolonged contact with the HCW (e.g., within 2 meters in an enclosed common area when the HCW was wearing a surgical/procedure mask

The following guidance is for HCW with symptoms. Includes HCW with COVID-19; HCW that develop symptoms following an exposure; and suspected cases:

- **HCW with symptoms, NOT tested:**
  - If all symptoms are resolved (except for a dry cough) + 10 days have elapsed since start of symptoms + there was no travel outside of Canada=Return to work. IF there was travel outside of Canada, they can return after the 14-day self-isolation (and no symptoms)

Factors influencing exposure:

- Duration of exposure; Type of interaction; extent of body contact; clinical presentation of patient symptoms; patient masking; donning/doffing PPE; hand hygiene, PPE.

Decision tree/exposure risk assessment tool:

- **Step 1:** Determine HCW PPE level
- **Step 2:** Determine patient exposure scenario
- **Step 3:** Determine risk level

The following guidance is for HCW with symptoms. Includes HCW with COVID-19; HCW that develop symptoms following an exposure; and suspected cases:

- **HCW with symptoms, NOT tested:**
  - If symptoms have not resolved=Self-isolate
  - If resolved, but 10 days have elapsed since start of symptoms = Self-isolate
  - If 10 days has elapsed but there was travel outside of Canada and the 14-self-

British Columbia CDC
Provincial level, CA
Date: Oct 5, 2020
Step 4: Implement recommended measures

- **No Risk:**
  - IF all appropriate PPE was worn and there was 2 meter distance and less than 15 minute interaction = No Risk

- **Low Risk:**
  - No gloves/gown but had mask and eye protection = Low risk
  - No surgical mask/no eye protection but patient wore mask = Low Risk
  - Performed AGMP + wore surgical mask = Low Risk
  - No PPE but patient wore mask = Low Risk

- **High Risk:**
  - No PPE and patient did not wear a mask = High risk
  - No surgical mask/eye protection and patient did not wear a mask and patient has active cough or cough-inducing procedure = high risk
  - Perform AGMP + no N (%/No eye protection) = High risk

Recommendations based on exposure risk (see risk assessment in exposure definitions):

- **No Risk + asymptomatic:**
  - Not considered a close contact
  - Continue to work following general precautions

- **Low Risk + asymptomatic:**
  - Continue to work
  - Self-monitor for symptoms for 14 days

- **High Risk + asymptomatic + essential:**
  - Continue to work WITH precautions (wear mask at all times and physical distance)
  - Self-monitor for symptoms for 14 days

- **High Risk + asymptomatic + non-essential:**
  - Exclude from work and self-isolate for 14 days
  - Self-monitor for symptoms

- **HCW with symptoms who tested NEGATIVE:**
  - If all symptoms are resolved (except dry cough) AND there was no travel outside of Canada in the past 14 days = Return to work.
  - If travel outside of Canada, they can return to work after their 14-day isolation.

- **HCW with symptoms and POSITIVE test**
  - If all symptoms have resolved (except dry cough) + 10 days have elapsed since start of symptoms = Return to work.
| World Health Organization (WHO) | HCW-risk assessment tool/form | If any risk level (No, Low or High) develops symptoms:  
- Exclude from work and self-isolate until cleared to return to work  
- Get tested. |
|--------------------------------|-----------------------------|------------------------------------------------------------------|
| **Global level**              | If a HCW provided direct care for a COVID-19 patient OR had face-to-face contact OR were present during an aerosol generating procedure OR had direct contact with a COVID-19 patient’s environment, then the HCW should consider themselves as being exposed.  
- Questions regarding adherence to IPC procedure during health care interactions, and adherence to IPC measures when performing aerosol-generating procedure and Accidents with biological material determine risk categorization  
- In short, if a HCW did not respond ‘Always, as recommended’ when quantifying the frequency in which they wore their PPE as recommended, OR experienced an interaction with a COVID-19 patient where anybody fluid/resp secretion accident occurred, they are considered high risk  
| Management of HCW exposure varies according to risk categorization.  
High risk Exposure: Stop all health care interactions with patients for a 14-day period after the last day of exposure to a confirmed COVID-19 patient; get tested; quarantine for 14 days in designated setting  
Low Risk Exposure: Self-monitor temp and resp symptoms daily for 14 days after last exposure to a COVID-19 patient; call healthcare facility if symptoms develop; reinforce contact and droplet precautions when caring for all patients with acute res illness and standard precautions for all patients; reinforce airborne precautions for aerosol procedures on suspected or confirmed cases; reinforce the rational, correct, and consistent use of personal protective equipment; apply hand hygiene practice respiratory etiquette at all times  
| None specified, see isolation requirements |
| **Date:** March 19, 2020      |                             |                                                                  |

| Centers for Disease Control and Prevention (CDC) | Healthcare personnel (HCP) | If any risk level (No, Low or High) develops symptoms:  
- Exclude from work and self-isolate until cleared to return to work  
- Get tested. |
|-------------------------------------------------|-----------------------------|------------------------------------------------------------------|
| **National level, USA**                         | **Higher risk** for HCP. e.g., prolonged exposure to patients with COVID-19 when HCP’s eyes, nose, or mouth are not covered  
- If HCP had exposure to prolonged close contact with confirmed case; did not wear resp or facemask; did not wear eye protection (if patient was not wearing face covering); did not wear recommended PPE during aerosol-generating procedure: SEE isolation column  
- Other exposures not included as higher risk, including having body contact with the patient (e.g., rolling the patient) without gown or gloves, may impart some risk for transmission, particularly if hand hygiene is not |  
| **High Risk**                                  |                             |                                                                  |
| - Exclude from work for 14 days after last exposure  
- Monitor for fever or symptoms  
- If symptoms develop contact established point of contact for evaluation and testing.  
|  
| Not meeting criteria for high risk              |                             |                                                                  |
| - No work restrictions  
- follow IPC guidance including continuous masking and self-monitoring for symptoms daily and before each shift  
- HCW should not report to work if ill and any onset of fever or other COVID-19  
|  
| Not specified see isolation column              |                             |                                                                  |
| **Date:** June 18, 2020                         |                             |                                                                  |

performed and HCP then touch their eyes, nose, or mouth.

- The specific factors associated with these exposures should be evaluated on a case by case basis; interventions, including restriction from work, can be applied if the risk for transmission is deemed substantial.

- The definition of “prolonged” was extended to refer to a time period of 15 or more minutes; any duration should be considered prolonged if the exposure occurs during performance of an aerosol-generating procedure.

associated symptoms must self-isolate immediately and arrange testing.

<table>
<thead>
<tr>
<th>Centers for Disease Control (CDC)</th>
<th>Healthcare worker – all paid and unpaid persons serving in healthcare settings who have the potential for direct or indirect exposure to patients or their infectious secretions and materials (e.g., doctors, nurses, laboratory workers, facility maintenance workers, clinical trainees, volunteers).</th>
</tr>
</thead>
</table>
| **High risk exposure:**     | - Close contact with a person with COVID-19 in the community; OR  
- Providing direct patient care for a patient with COVID-19 (e.g., physical exam, nursing care, performing aerosol-generating procedures, specimen collection, radiologic testing) without using proper personal protective equipment (PPE) or not performing appropriate hand hygiene after these interactions; OR;  
- Having contact with the infectious secretions from a patient with COVID-19 or contaminated patient care environment, without using proper personal protective equipment (PPE) or not performing appropriate hand hygiene. |
| **Low risk exposure:**       | - Contact with a person with COVID-19 having not met criteria for high-risk exposure (e.g., brief interactions with COVID-19 patients in the hospital or in the community). |
| **Considerations when managing exposed HCW:** (paraphrased): | Epidemiology of community.  
Staffing levels; availability of IPC personnel; access to resources that limit burden of HCW active monitoring. |
| **A. Exposed HCW with symptoms:** | - Immediately restricted from work until a medical evaluation can be completed and testing for COVID-19 considered. |
| **B. Exposed HCW, asymptomatic:** | - An assessment can be done to determine the risk category of exposure, necessary work restriction, and monitoring for 14 days.  
High Risk Exposure: HCW should be restricted from work and remain quarantined with active monitoring for COVID-19 symptoms for 14 days after the date of last exposure.  
Low Risk Exposure: If low-risk exposure and are considered essential staff may continue to work during the 14 days after their last exposure to a patient with COVID-19.  
These HCWs should preferably be assigned to care for patients with COVID-19 and should perform self-monitoring twice a day.  
If the worker is scheduled for a shift, they should take their temperature and self-evaluate for symptoms before reporting to work.  
Healthcare facilities can consider establishing protocols in which HCWs under self-monitoring report their temperature and symptom status to IPC staff, employee/occupational health, or a risk assessment, if possible, with recommended active or self-monitoring depending on the exposure risk level. To avoid critical staffing shortages, some facilities have allowed asymptomatic exposed staff, including those with high-risk exposures, to continue working while wearing a medical mask to reduce the risk of asymptomatic or pre-symptomatic transmission. However, PPE shortages may not allow this strategy to work for many facilities. |
<table>
<thead>
<tr>
<th>Research Question • 35</th>
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<tbody>
<tr>
<td>Research Question</td>
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<tr>
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<tr>
<td>designated supervisor prior to beginning a shift.</td>
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<tr>
<td>- If develop symptoms: do not report to work, alert their point of contact and be restricted from work until medical eval and testing.</td>
</tr>
<tr>
<td>- If testing is negative and symptoms are resolved, they may return to work while observing standard precautions and continuing to self-monitor for the remainder of the 14 days. Some facilities have instructed any exposed staff that continue working during the 14 days post-exposure (e.g., asymptomatic low-risk exposure or staff who had symptoms, tested negative and returned to work within the exposure period) to wear a medical mask at all times.</td>
</tr>
<tr>
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<tr>
<td>Health Care Personnel (HCP)</td>
</tr>
<tr>
<td>Contingency strategies to mitigate staff shortages:</td>
</tr>
<tr>
<td>- Developing plans to allow asymptomatic HCP who have had an unprotected exposure to SARS-CoV-2 (the virus that causes COVID-19) but are not known to be infected to continue to work:</td>
</tr>
<tr>
<td>- These HCP should report temperature and absence of symptoms before work</td>
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<tr>
<td>- These HCP should mask while at work for 14 days after exposure</td>
</tr>
<tr>
<td>- If testing is readily available, performing post-exposure testing during the 14-day post-exposure period can be considered</td>
</tr>
<tr>
<td>- If HCP develop even mild symptoms consistent with COVID-19, they must cease patient care activities</td>
</tr>
<tr>
<td>Crisis Capacity Strategies to mitigate shortages:</td>
</tr>
<tr>
<td>- If shortages continue despite other mitigation strategies, consider implementing criteria to allow HCP with suspected or confirmed COVID-19 who are well enough and willing to work but have not met all Return to Work Criteria to work.</td>
</tr>
<tr>
<td>- If HCP are allowed to work before meeting all criteria, they should be restricted from contact with severely immunocompromised patients (e.g., transplant, hematology-oncology) and facilities should consider prioritizing their duties in the following order:</td>
</tr>
<tr>
<td>1. If not already done, allow HCP with suspected or confirmed COVID-19 to perform job duties where they do not interact with others (e.g., patients or other HCP), such as in telemedicine services.</td>
</tr>
<tr>
<td>2. Allow HCP with confirmed COVID-19 to provide direct care only for patients with confirmed COVID-19, preferably in a cohort setting.</td>
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<tr>
<td>3. Allow HCP with confirmed COVID-19 to provide direct care for patients with suspected COVID-19.</td>
</tr>
<tr>
<td>4. As a last resort, allow HCP with confirmed COVID-19 to provide direct care for patients without suspected or confirmed COVID-19.</td>
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<td>Source</td>
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</table>
| Centers for Disease Control and Prevention (CDC) | Healthcare personnel (HCP) with confirmed SARS-CoV-2 infection, or who have suspected SARS-CoV-2 infection but were never tested for SARS-CoV-2. | This document refers to HCW with positive infection but refers to another doc for exposure guidance | • Decisions about return to work should be made in the context of local circumstances. In general, a symptom-based strategy should be used. The time period used depends on the HCP’s severity of illness and if they are severely immunocompromised.  
• A test-based strategy is no longer recommended (except as noted below) because, in the majority of cases, it results in excluding from work HCP who continue to shed detectable SARS-CoV-2 RNA but are no longer infectious  
• Mild to moderate illness and not severely immunocompromised: at least 10 days since symptoms first appeared and at least 24 hr since last fever (without use of fever reduction meds) and symptoms have improved  
• If not severely immunocompromised and asymptomatic through infection, they can return 10 days after their positive test.  
• Sever to critical illness OR immunocompromised: at least 10 and up to 20 days since symptoms started. 24 hours since last fever and symptoms have improved. Consider consultation with infection control experts  
• Severely immunocompromised and asymptomatic: can return 10 days and up to 20 days after their positive test. In some instances, a test-based strategy could be considered to allow HCP to return to work earlier than if the symptom-based strategy were used. |
| National level, USA | | | |
| Date: Aug 10, 2020 | | | |
| Centers for Disease Control and Prevention. (2020, June 18). Interim U.S. Guidance for Risk Assessment and Work Restrictions for Healthcare | - If HCP had exposure to prolonged close contact with confirmed case; did not wear resp or facemask; did not wear eye protection (if patient was not wearing face covering); did not wear recommended PPE during aerosol-generating procedure: SEE isolation column | | • Exclude from work for 14 days after last exposure  
• Monitor for fever or symptoms  
If symptoms develop contact established point of contact for evaluation and testing.  
• Not specified see isolation column |
**Personnel with Potential Exposure to COVID-19**: Potential Exposure at Work.

- **Higher risk** for HCP, e.g., prolonged exposure to patients with COVID-19 when HCP’s eyes, nose, or mouth are not covered.

- **Other exposures not included as higher risk**, including having body contact with the patient (e.g., rolling the patient) without gown or gloves, may impart some risk for transmission, particularly if hand hygiene is not performed and HCP then touch their eyes, nose, or mouth.

-Higher risk for HCP. e.g., prolonged exposure to patients with COVID-19 when HCP’s eyes, nose, or mouth are not covered

- Other exposures not included as higher risk, including having body contact with the patient (e.g., rolling the patient) without gown or gloves, may impart some risk for transmission, particularly if hand hygiene is not performed and HCP then touch their eyes, nose, or mouth.

-The specific factors associated with these exposures should be evaluated on a case by case basis; interventions, including restriction from work, can be applied if the risk for transmission is deemed substantial.

-The definition of “prolonged” was extended to refer to a time period of 15 or more minutes; any duration should be considered prolonged if the exposure occurs during performance of an aerosol-generating procedure.

American College of Emergency Physicians
National level, USA
Date: unknown

**Exposure Categories:**
A. For prolonged close contact with COVID patient who was wearing a face mask:
- **Low exposure**:
  - HCP not wearing gown or gloves
  - HCP not wearing PPE
  - HCP not wearing eye protection
- **Medium exposure**:
  - HCP not wearing PPE
  - HCP not wearing mask or respirator

B. For prolonged close contact with COVID patient who was NOT wearing a face mask:
- **Low exposure**:
  - HCP not wearing gown or gloves
- **Medium exposure**:
  - HCP not wearing PPE
  - HCP not wearing eye protection

Work Restrictions for asymptomatic HCP based on exposure risk:
- **Low Exposure**: None
- **Medium Exposure**: exclude from work for 14 days after last exposure
- **High Exposure**: exclude from work for 14 days after last exposure

Note: Both high- and medium-risk exposures place HCP at more than low risk for developing infection; therefore, the recommendations for active monitoring and work restrictions are the same for these exposures. These risk categories were created to align with risk categories described in the “Interim US Guidance for Risk Assessment and Public Health Management of Persons With Potential Coronavirus Disease (COVID-19) Exposure in Travel-
### Research Question • 38

| Minnesota Department of Health | HCW | - HCP wearing all recommended PPE (except wearing a face mask instead of a respirator)  
• **Medium Exposure:**  
  - HCP not wearing eye protection  
• **High exposure:**  
  - HCP wearing no PPE  
  - HCP not wearing mask or respirator | Associated or Community Settings, which outlines criteria for quarantine and travel restrictions specific to high-risk exposures. Use that interim guidance for information about the movement, public activity, and travel restrictions that apply to the HCP included here  

| Kentucky Department for Public Health | Those who work in healthcare setting | Exposed but not yet symptomatic  
⇒ | For those exposed but not symptomatic:  
- Quarantine for 14 days if possible |  

- HCW living with a person suspected of having COVID-19, or who have been exposed to a patient or coworker with COVID-19, have expressed concerns regarding self-quarantine and exclusion from work  
  
- Unprotected (high-risk) exposure to a patient or coworker with confirmed COVID-19.  
  
- These recommendations are relevant for HCW who have had a high-risk workplace exposure to COVID-19 and HCW with household, intimate or close community contacts who have confirmed or suspected COVID19.  
  
- HCW with high-risk exposures participate in voluntary quarantine for 14 days after the exposure.  
• If the facility is experiencing a staffing shortage that cannot otherwise be resolved, asymptomatic high risk HCW may be asked to return to work during the voluntary quarantine period, provided the HCW wears a surgical face mask for source control  
• Limit interactions with the public as much as possible for 14 days after preventive measures are put into place, adhering to social distancing and working from home, if possible. If these limitations are not possible, the HCW should take on a non-direct patient care role (e.g., telemedicine, phone triage), when feasible  
• Instead of 14-day work exclusion for asymptomatic HCW who have had an [exposure], health care facilities might shift priority to reporting of recognized exposures, regular self-monitoring for fever and respiratory symptoms, testing HCWs with recognized high-risk exposures and refraining from work when ill. This approach is relevant for facilities with sufficient PPE to ensure that high-risk exposures are unlikely, have the ability to actively assess PPE breaches after every employee’s shift, and are committed to exclusion of ill staff.  
• If necessary, for the HCW to continue providing direct patient care during the 14-day period, they should:  
  - Avoid seeing high-risk patients (e.g., elderly and immunocompromised persons and those with comorbidities).  
  - Practice diligent hand hygiene and wear a surgical face mask at all times.  
  - Monitor themselves closely for any new symptoms associated with COVID-19 (i.e., measured or subjective fever, cough, shortness of breath, chills, headache, muscle pain, sore throat, or loss of taste or smell), and measure their temperature daily before going to work.  
  - Remain at home and notify their supervisor if they develop respiratory symptoms OR have a measured body temperature of ≥100°F.  
  - If at work when fever or respiratory symptoms develop, the HCW should immediately notify their supervisor and go home.  
  - Notify their supervisor of other symptoms (e.g., fever <100°F, nausea, vomiting, diarrhea, abdominal pain, runny nose, fatigue), as medical evaluation might be recommended.  

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**Minneapolis Department of Health**  
**State level, USA**  
**Date: Sept 24, 2020**  
**Minnesota Department of Health.**  
https://www.health.state.mn.us/diseases/coronavirus/hcp/hcwrecs.pdf

**Kentucky Department for Public Health**  
Those who work in healthcare setting  
⇒  
For those exposed but not symptomatic:  
- Quarantine for 14 days if possible
<table>
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<tr>
<th>State level, USA</th>
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<th>University of California San Francisco (UCSF)</th>
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<tbody>
<tr>
<td>Those returning to work with confined population environments (eg, LTCF, prison, behavioral health hospitals) after a confirmed or suspected COVID case</td>
<td>Returning after positive case</td>
<td>Staff includes all employees, faculty, temporary workers, trainees, volunteers, students</td>
</tr>
<tr>
<td>1. Worked at a non-UCSF health care facility and participated in direct care or had close contact with patients diagnosed with COVID-19 in the past 14 days</td>
<td>1. -Can work if not symptomatic and: -self-monitor twice a day, -hand hygiene, -Stop work if symptomatic -If working in high-risk area you can continue to work if asymptomatic and confirm absence from medium or high-risk exposure</td>
<td>1. Worked at a non-UCSF health care facility and participated in direct care or had close contact with patients diagnosed with COVID-19 in the past 14 days</td>
</tr>
<tr>
<td>2. Unprotected, prolonged close contact with a confirmed case in past 14 days. -Unprotected means 1) no respirator or face mask; 2) mask but no eye protection if person with COVID19 was not wearing face covering or mask; 3) not wearing all recommended PPE while performing aerosol-generating procedures -Prolonged means close contact defined as 6’ for &gt;=15 mins</td>
<td>2. Cannot work unless they have and OHS letter</td>
<td>2. Cannot work unless they have and OHS letter</td>
</tr>
<tr>
<td>3. Informed of low risk exposure to patient, visitor or worker with COVID-19 in past 14 days</td>
<td>3. Can work if asymptomatic -self-monitor twice a day -hand hygiene, -Stop work if symptomatic</td>
<td>3. Can work if asymptomatic -self-monitor twice a day -hand hygiene, -Stop work if symptomatic</td>
</tr>
<tr>
<td>Risk Exposure: • High risk: -patient and staff unmasked</td>
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</tbody>
</table>
- **Medium Risk:**
  - Patient wearing mask + staff unmasked
  - Patient unmasked + staff wearing face mask and no eye protection

- **Low Risk:**
  - Patient wearing face mask + staff wearing face mask and no eye protection
  - Patient unmasked OR wearing face mask + staff wearing face mask AND eye protection

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**High Risk Exposure:**
- performed or present during high-risk respiratory AGP where the case patient was not masked and where the HCP was missing some element of PP. This includes HCP that wore all other recommended PP BUT wore a mask instead of respirator during AGP
- HCP who had prolonged close contact (within 6 feet for 15 or more min or direct contact with unprotected secretions/excretions) of case while not wearing resp or face mask OR while not wearing eye protection if the case was not wearing mask or covering.
- COVID-19 cases are considered to be infectious beginning 2 days prior to symptom onset (or initial positive viral test if case is asymptomatic) until the time they meet criteria for discontinuing isolation.

**High Risk Exposure:**
- HCP with high risk exposures to COVID-19 should be excluded from work for 14 days (with exceptions made for staffing shortages-see below).
- They should be instructed to monitor themselves for fever or symptoms consistent with COVID-19 and to immediately contact their established point of contact (e.g. occupational health program) if symptoms develop. HCP can return to work after 14 days if they have never had symptoms.
- HCP with other healthcare exposures have no work restrictions, should continue to follow all recommended infection prevention and control practices including universal source control, and continue the monitoring as outlined in this guidance.

**Staffing Shortage:**
- Healthcare facilities experiencing staffing shortages of essential HCP may allow HCP with high risk exposures to SARS-CoV-2 to continue to work as long as they remain asymptomatic and wear a facemask for source control for the full 14 days after the exposure event. The HCP must observe full home quarantine when not doing their essential work.

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Los Angeles County Department of Public Health
Municipal level
Date: Jul 24, 2020
Public Health England  
National level, UK  
Date: Sept 28, 2020  


Health and social care staff (HCW)

**Close Contact:**  
If HCW providing direct care to a patient or a resident with COVID-19 and are wearing the correct PPE in accordance with the current IPC guidance, they will not be considered as a contact for the purposes of contact tracing and isolation, and will not be required to self-isolate for 14 days.

- The use of PPE in other settings (such as a staff room or canteen) will not necessarily exclude an individual from being considered a close contact.

- In addition, if health and social care staff have been in contact with a COVID-19 case and are not following appropriate IPC, including wearing correct PPE, they will be considered as a contact for the purposes of contact tracing and isolation.

- If a health or social care worker is considered to be a contact, and the recommendation for them to self-isolate would have implications for the provision of the service, their employer will need to escalate this for a risk-assessment to a Tier 1 contact tracer. The risk-assessment should take account of any PPE use and other mitigating factors that may reduce the risk of infection transmission to such an extent that the individual identified as a contact does not need to self-isolate.

**Risk assessment:** Assessing whether a HCW has had a breach of PPE, a risk assessment should be undertaken in conjunction with local infection prevention and control (IPC) policy considering:

- severity of patient symptoms,
- length of exposure
- proximity to the patient
- activities that took place (e.g., AGP)
- where HCW had eyes, mouth or nose exposed.

- If a staff member has been notified that they are a contact of a co-worker who has been confirmed as a COVID-19 case, and contact with this person occurred while not wearing PPE, the 14-day isolation period also applies.

- If the risk assessment (see exposure notes) concludes there has been a significant breach or close contact without PPE, the worker should remain off work for 14 days.

Return to work criteria provided for asymptomatic and symptomatic HCW, and if a close contact in community.
<table>
<thead>
<tr>
<th>Close Contact Exposure:</th>
<th>HCW Close Contact:</th>
</tr>
</thead>
<tbody>
<tr>
<td>HCWs (excluding lab workers) who have:</td>
<td>- May not remain at work, should restrict movement and undergo active follow-up: self-monitor for symptoms, provide contact details to OH, OH to be in contact every day to ask about relevant symptoms for 14 days post-exposure</td>
</tr>
<tr>
<td>- Cumulative unprotected exposure during 1 work shift (i.e., any breach/omission of appropriate PPE) for more than 15 minutes face-to-face</td>
<td>- Testing of HCW carried out on day 0 (date identified as close contact) and day 7 (post-last contact); if day 0 test is positive, no further test is required and HCW to self-isolate; while waiting for test results, all HCWs must restrict movement for full 14 days; if test comes back positive, HCW must self-isolate for 10 days post-date of test</td>
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<tr>
<td>- Any unprotected exposure of eyes or mouth or mucus membranes, to bodily fluids (e.g., coughing) of positive case</td>
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<tr>
<td>- Any unprotected exposure (i.e., breach of appropriate PPE) while present in same room when aerosol generating procedure is undertaken on positive case</td>
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</tbody>
</table>

Casual Contact Exposure:

HCWs (excluding lab workers) who have taken recommended infection control precautions, including use of appropriate PPE during infectious period for following type of exposure to positive case:

- Cumulative protected exposure during 1 work shift for more than 15 minutes face-to-face (less than 1m distance)
- Any protected exposure to bodily fluids of positive case
- Any protected exposure while present in same room when aerosol generating procedure is undertaken on positive case
- Any cumulative unprotected exposure during 1 shift (i.e., breach/omission of appropriate PPE) for less than 15 minutes face-to-face (less than 1m distance) to positive case

Laboratory Workers:

- Lab HCWs who have not fully adhered to good lab practice in 1 work shift for less than 15 minutes, while testing samples as Casual Contacts
- Lab HCWs who have not fully adhered to good lab practice for 15 minutes or more in 1 work shift, while testing samples classified as Close Contacts

HCW Casual Contact:

- Must undergo passive follow-up: asymptomatic contact can remain at work; symptomatic contact may not remain at work and restrict movement, self-monitor for 14 days after last potential exposure and contact OH/Emergency is symptoms develop

HCW Close Contact:

- If HCW remains asymptomatic throughout monitoring period, they may return to work after 14 days
- HCWs who are symptomatic may return to work 10 days after symptom onset AND 5 days with no fever. *a persistent cough is possible for a period of time after infection and will not impact HCW return to work

HCW Casual Contact:

- If HCW remains asymptomatic, they can remain at work.
- HCWs who are symptomatic must leave work and self-isolation; they may return to work 10 days after symptom onset AND 5 days with no fever

Derogation of Essential HCWs:

- If an area cannot be staffed safely or a critical skill set to provide critical/essential services is unavailable, derogation from management may be given to HCWs from identified critical services to return to workplace under appropriate monitoring
- Where HCW is a close contact, managers must consider specific risk of this close contact; there is increased risk of exposure if aerosol generating procedures were carried out during their unprotected contact, or if they had unprotected contact with multiple index cases
- HCWs who are symptomatic cannot return to work

Essential HCWs Requiring Active Monitoring:

- Essential HCWs who are close contacts (community or workplace) may return to work with active monitoring (i.e., symptom check, temperature check) for remainder of 14 days of isolation/restricted movement
- HCW close contacts of family members should not be derogated due to increased likelihood of transmission
First check must be done before HCW return to work
| Queensland Health  
State-level, AUS  
Date: June 24, 2020, Version 1.13  
Interim infection prevention and control guidelines for the management of COVID-19 in healthcare setting.  
This document provides staffing recommendations for staff caring for COVID-19 patients.  
-HCW caring for patients with COVID-19 should carefully monitor and document their own health until 14 days after the last known contact with a COVID-19 patient regardless of PPE use.  
-If a HCW who has cared for a patient with suspect, probable or confirmed COVID-19 develops any acute illness or signs or symptoms such as sore throat, fever, cough, or shortness of breath they should [see isolation column] | If a HCW who has cared for a patient with suspect, probable or confirmed COVID-19 develops any acute illness or signs or symptoms they should:  
• stop work or not report for work  
• notify their line manager and healthcare facility infection control unit  
• seek medical evaluation and call ahead to notify the facility that they have cared for a patient with suspect, probable or confirmed COVID-19  
not return to the workplace until they have a clearance to do so. | None listed but note: The Communicable Diseases Network of Australia National Guidelines for Public Health Units: Coronavirus Disease 2019 for requirements for healthcare worker clearance. |
Appendix

List of Abbreviations
aHR: adjusted hazard ratio
AHS: Alberta Health Services
AOR: adjusted odds ratio
CI: confidence interval
COVID-19: Coronavirus Disease-2019
d: Day
HCW: health care worker
KRS: Knowledge Resource Services
LTC: Long-term care
PLR: positive likelihood ratio
RR: relative risk
RT-PCR: Reverse transcription polymerase chain reaction
SAG: Scientific Advisory Group
SARS-CoV-2: Severe acute respiratory syndrome coronavirus 2

Methods

Literature Search
A literature search was conducted by Rachel Zhao from Knowledge Resources Services (KRS) within the Knowledge Management Department of Alberta Health Services. KRS searched databases for articles published 2020-current. Search was conducted in OVID MEDLINE, TRIP PRO, BMJ Best Practice, WHO Covid-19 Database, CADTH and COVID-19, CEBM, US CDC, COVID-19 Evidence Alerts from McMaster PLUS, medRxiv, bioRxiv, European Centre for Disease Prevention and Control, National Collaborating Centre for Methods and Tools, NICE, Google and Google Scholar. Citation tracking was applied on some key articles in Google Scholar. Briefly, the search strategy involved combinations of keywords and subject headings including:
- SARS-CoV-2; COVID-19
- Healthcare worker
- Occupational exposure
- Diagnostic tests

A total of 2758 results were retrieved from all resources before deduplication, with 2422 results after deduplication. Of which, 163 results were kept after title/abstract screening of the 2422 results. Overall, 83 studies are included in the current report based on the inclusion/exclusion criteria table below.
Table. Inclusion and exclusion criteria for results of the literature search

<table>
<thead>
<tr>
<th>Inclusion Criteria</th>
<th>Exclusion Criteria</th>
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<tbody>
<tr>
<td>1. COVID-19</td>
<td>1. Article is not from a credible source</td>
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<tr>
<td>2. Describes at least one of the following:</td>
<td>2. Article does not have a clear research question or issue</td>
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<tr>
<td>• Incubation period (e.g. exposure to symptom onset)</td>
<td>3. Presented data/evidence is not sufficient to address the research questions</td>
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<tr>
<td>• HCW exposures and quarantine/isolation periods (proportion symptomatic, confirmed positive, etc)</td>
<td>4. SARS or MERS studies</td>
</tr>
<tr>
<td>• Timing/frequency of post-exposure testing</td>
<td>5. No outcomes described (e.g., incubation period, exposure risk, quarantine to infected ratio, post exposure testing)</td>
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<tr>
<td>• Guidelines for HCW quarantine following exposure</td>
<td>6. Primary focus is on methods of testing without with application to asymptomatic testing</td>
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<tr>
<td>3. Setting and population: healthcare workers across continuum of care</td>
<td>7. Influenza, RSV, circulating coronavirus, or another contagious virus</td>
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<td>4. Date of research: 2020-current</td>
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<td>5. Research methods: all</td>
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<td>6. Language of report: English</td>
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<td>7. Publication status: pre-print, peer reviewed, grey literature</td>
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<td>8. Geographical location: international</td>
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Search Strategy

**Search Strategies**

Ovid MEDLINE(R) and In-Process & Other Non-Indexed Citations and Daily 1946 to September 29, 2020

<table>
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<tr>
<td>1</td>
<td>exp Coronavirus/ or Coronavirus Infections/ or coronaviru*.mp. or corona viru*.mp. or ncov*.mp. or n-cov*.mp. or COVID-19.mp. or COVID19.mp. or COVID-2019.mp. or COVID2019.mp. or SARS-CoV-2.mp. or SARS-CoV-2.mp. or SARS-CoV2.mp. or SARS-CoV19.mp. or SARS-Cov-19.mp. or SARSCov-19.mp. or SARSCov-2019.mp. or severe acute respiratory syndrome coronavirus*.mp. or severe acute respiratory syndrome cov 2.mp. or 2019 ncov.mp. or 2019ncov.mp.</td>
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<td>exp Health Personnel/ or (health practitioner* or health professional* or healthcare worker* or health-care worker* or healthcare personnel or health care personnel or health-care personnel or healthcare practitioner* or health care practitioner* or health-care practitioner* or health care professional* or health-care professional* or health worker* or health* personnel or dental* or dentist* or denturist* or emergency medical technician* or home health aide* or medical record administrator* or medical secretar* or medical receptionist* or psychiatric aide* or operating room technician* or pharmacist* or physical therapist* or anatomist* or anesthetist* or audiologist* or case manager* or coroner* or medical examiner* or endodontist* or orthodontist* or doula* or epidemiologist* or health facility administrator* or hospital administrator* or hospital chief executive officer* infection control practitioner* or medical chaperone* or medical lab* personnel or medical staff or hospitalist* or nursing or nurse or nurses or nutritionist* or occupational therapist* or optometrist* or hospital volunteer* or physical therapist* or physician* or doctor or doctors or allergist* or anesthesiologist* or cardiologist* or dermatologist* or endocrinologist* or gastroenterologist* or general practitioner* or geriatrician* or nephrologist* or neurologist* or oncologist* or otolaryngologist* or pathologist* or neonatologist* or physiatrist* or</td>
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<td>pulmonologist* or radiologist* or rheumatologist* or surgeon* or neurosurgeon* or ophthalm* or urologist*).kf,tw.</td>
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<td>4</td>
<td>expos*.kf,tw.</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>3 or 4</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>1 and 2 and 5</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Quarantine/</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>(quarantine* or isolat* or self-isolat*).kf,tw.</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>7 or 8</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>&quot;diagnostic techniques and procedures&quot;/ or clinical laboratory techniques/</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>(test or tests or testing* or tested).kf,tw.</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>10 or 11</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>1 and 2 and 12</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>9 or 12</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>1 and 5 and 14</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>6 or 13 or 15</td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>limit 16 to (english language and yr=&quot;2020 -Current&quot;)</td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>remove duplicates from 17</td>
<td></td>
</tr>
</tbody>
</table>

**TRIP Database Pro**

(health practitioner* or health professional* or healthcare worker* or health care worker* or health-care worker* or healthcare personnel or health care personnel or health-care personnel or healthcare practitioner* or health care practitioner* or health-care practitioner* or healthcare professional* or health care professional* or health-care professional* or health worker* or health* personnel) AND (quarantine or isolate* or self-isolat* or test or tests or testing* or tested) AND (day or days or frequency) AND (coronaviru* OR "corona virus" OR ncov* OR n-cov* OR COVID-19 OR COVID19 OR COVID-2019 OR COVID2019 OR SARS-COV-2 OR SARSCOV-2 OR SARSCOV19 OR SARS-COV-19 OR SARSCOV-19 OR SARSCOV2 OR SARSCOV-2019 OR SARS-COV-2019 OR "severe acute respiratory syndrome cov 2" OR "severe acute respiratory syndrome coronavirus" OR "2019 ncov" OR 2019ncov OR Hcov*) from:2020 area:"Infectious Disease"

**WHO COVID-19 Database**

(health practitioner* or health professional* or healthcare worker* or health care worker* or health-care worker* or healthcare personnel or health care personnel or health-care personnel or healthcare practitioner* or health care practitioner* or health-care practitioner* or healthcare professional* or health care professional* or health-care professional* or health worker* or health* personnel) AND (quarantine or isolate* or self-isolat* or test or tests or testing* or tested) AND (day or days or frequency) from:2020 area:"Infectious Disease"

**Google / Google Scholar**

healthcare worker exposure to COVID-19 quarantine or testing
Reference List


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Mandić-Rajčević S., Masci F., Crespi E., Franchetti S., Longo A., Bollina I., et al. (2020). Contact tracing and isolation of asymptomatic spreaders to successfully control the COVID-19 epidemic among healthcare workers in Milan (Italy). *medRxiv*, Jan 1;2020.05.03.20082818. https://www.medrxiv.org/content/10.1101/2020.05.03.20082818v1


