COVID-19 Scientific Advisory Group
Rapid Evidence Report

Topic: What criteria should AHS use to inform changes to COVID-19 Personal Protective Equipment (PPE) guidelines in acute and long-term care?

1. **Can the prevalence of COVID-19 in the community be used to predict the likelihood of healthcare-based outbreaks?**

    a. **If so, can levels of risk be identified to inform recommendations for PPE based on community prevalence?**
    b. **How are risk levels impacted by the proportion of community cases with an unknown source?**

2. **What guidelines do other jurisdictions use to determine PPE requirements? Are there common features to these guidelines?**

3. **What degree of protection is offered from universal masking in healthcare, including evidence for the utility of medical masks in preventing transmission from an infected person (source control)?**

    a. **What degree of additional protection results from the sequential addition of a) continuous face shield/eye protection, b) contact and droplet precautions, c) continuous N95 mask use, each in comparison to continuous masking and hand hygiene?**

4. **Are there risks (to patient care, patient wellbeing, healthcare workers, adherence/behavior or other) to use of continuous PPE/isolation?**

5. **Which care areas (e.g. ICU, emergency, perioperative care) pose the highest risk of COVID-19 for healthcare workers?**

This report is organized as follows:

Context

- The incidence of COVID-19 has increased dramatically across all jurisdictions. On December 9, there were 75054 total cases in Alberta since the start of the pandemic with 20,163 active cases in Alberta reflective of a current epidemic surge (GoA website).
- On December 8, 2020, new COVID-19 restrictions were introduced in Alberta. These restrictions included mandated masks in all indoor public places, including workplaces and places of worship.
- During the first wave of the pandemic, the peak number of new daily cases was 319 (23 April 2020), whereas currently during the second wave, the peak number of new cases to date has been 1872 (2 December 2020) (chi-csm.ca)
- Increasing community transmission increases the probability that healthcare workers, patients and visitors to the healthcare system may be COVID-19 positive with consequent risk of introduction and transmission within hospitals and long-term care.
- Currently, approximately 18 acute care facilities and 52 long-term care facilities are experiencing outbreaks, and 83 additional outbreaks are occurring in other supportive living/home living sites (https://www.alberta.ca/covid-19-alberta-data.aspx#p25721s5).
- In the last months an increased number of outbreaks and hospital-acquired cases of COVID-19 have been seen, that were not as evident during the first wave.
- Healthcare workers assessed as exposed in outbreaks require 14 days quarantine, and the PPE in use affects the assessment of potential exposure events and quarantine decisions. This has implications on availability of the healthcare workforce to manage surges in COVID-19 related admissions.
- In addition, differences between local and national PPE guidelines, and changes to guidelines over time have been seen as non-reassuring because of evolving, and sometime contradictory data, around the effectiveness of masks and other forms of PPE.
- The AHS PPE Task Force has been asked to review current guidelines regarding PPE, with some advocating for contact and droplet PPE (i.e. mask, eye protection, gown and gloves) for every patient encounter.
- Moving to a contact and droplet PPE policy for every patient encounter, if not supported by evidence that it will improve safety, has the potential for adverse and unintended consequences for both patients on isolation and staff, while also increasing concerns over maintaining PPE supply, which may or may not be offset by reduced HCW risk.
- In the midst of this review, AHS guidance changed with a recommendation for healthcare staff to use continuous eye protection in addition to previous measures of continuous masking, careful hand hygiene for all direct and indirect patient care, and comprehensive point-of-care risk assessments during a patient's stay to screen for new COVID19 compatible symptoms.
- This report is intended to collate evidence to inform the PPE Task Force on whether current PPE guidelines, in respect to exposure to a probable or confirmed COVID-19 patient, should be modified.

Terminology:

Continuous masking of HCW: refers to the continuous use of medical/surgical/procedural masks among healthcare workers (i.e. at all times except for when eating or drinking). Medical/surgical/procedural are used interchangeably throughout the report.

Universal masking of HCW: is synonymous to continuous masking of HCW.

Full PPE: will refer to the use of contact and droplet PPE (i.e. medical masks, eye protection, gowns and gloves; and use of a N95 respirator only if there is an aerosol generating medical procedure occurring in the room) and is used interchangeably with "contact and droplet" throughout the report.

Continuous masking of patients: refers to the continuous use of medical/surgical/procedural masks or cloth masks among patients. The type of mask (i.e. cloth vs medical) is captured verbatim from the individual studies or guidelines in the report.

Eye protection: refers to face shields, goggles or visors and will be used interchangeably within the report. Personal prescription eyewear does not count as eye protection.

Probable, Suspected or Confirmed COVID-19: Alberta-based definitions for probable, suspected or confirmed are assumed; except for the evidence summaries where terminology is captured verbatim from the literature.

Key Messages from the Evidence Summary

Research Question 1: Can the prevalence of COVID-19 in the community be used to predict the likelihood of healthcare-based outbreaks? If so, can levels of risk be identified that requirements for increased levels of PPE are triggered as community prevalence rises? How are risk levels impacted by the proportion of community cases with an unknown source?

- Evidence describing the relationship between community COVID-19 rates and the incidence of outbreaks across healthcare settings (i.e. acute care and long-term care) is limited. In the available published reports, there was variation in the methods used, and in the confounders measured and controlled for in the analyses. However, across studies the rates of COVID-19 in the surrounding community were found to be associated with COVID-19 infections and/or outbreaks in LTC settings.
- An analysis of local data also suggests an association between community incidence and acute care or LTC outbreaks. It should be noted that the definition of outbreaks has been variable across settings and over time, and the local data was not adjusted for additional community, facility or patient-level characteristics. Therefore, it is difficult to make firm conclusions based on this data.
- No studies were identified that quantified levels of community transmission predictive of outbreaks and thus it is not possible to identify any thresholds for changes to PPE. Further, even if a specific threshold of transmission for predicting outbreaks was determined, there was no evidence identified that quantified added benefits of different levels of PPE through to continuous full PPE (see Question 3). No studies evaluated risk levels that may be impacted by the proportion of community cases with an unknown source.
- The appropriate use of PPE in healthcare settings based on the level of community transmission should be considered in conjunction with measures to reduce community transmission.

Research Question 2: What guidelines do other jurisdictions use to determine PPE requirements? Are there common features to these guidelines?

- Several guidelines and guidance documents developed in other Canadian and international jurisdictions provide recommendations for minimum PPE requirements for HCWs in acute care and LTC settings. Broadly, contact and droplet precautions (face mask, gown, gloves, eye protection) are recommended for direct patient care of probable or confirmed cases of COVID-19.
- When performing an Aerosol Generating Medical Procedure (AGMP) on a patient with a suspected or confirmed acute viral respiratory infection, the use of an N95 respirator or equivalent in addition to contact and droplet protection (gown, gloves, eye protection) is recommended. The list of procedures comprising AGMP is noted to vary between jurisdictions. AHS guidance is HERE.
- Only 2 guidance documents (US CDC, Australian Government) addressed community levels of transmission when making PPE recommendations; however, community transmission levels were only qualitatively described (e.g. low levels, or significant levels). Recommendations for *continuous full droplet and contact PPE* were not identified in any provincial, territorial or other international guidelines.
- Both continuous HCW masking and masking of suspected or confirmed COVID-19 patients and LTC residents in the context of the COVID-19 pandemic were commonly recommended amongst guidelines reviewed. With respect to patient masking, current AHS practice is that patients with suspected or confirmed COVID-19 in acute care are asked to mask when leaving their room. New guidance from the WHO (December 1, 2020) recommends “in areas of known or suspected community or cluster SARS-CoV-2 transmission, universal masking for all persons (staff, patients, visitors, service providers and others) within the health facility (including primary, secondary, and tertiary care levels; outpatient care; and long-term care facilities), and wearing of masks by inpatients when physical distancing of at least 1 metre cannot be maintained or when patients are outside of their care areas.” However, this WHO guidance didn’t reference any high-quality research studies evaluating whether continuous masking of patients improves HCW safety.

Research Question 3: What degree of protection is offered from universal masking in healthcare, including evidence for the utility of medical masks in preventing transmission from an infected person (source control)? What additional protection results from the sequential addition of a) continuous face shield/eye protection b) contact and droplet precautions c) continuous N95 mask use, each in comparison to continuous masking and hand hygiene?

- Pooled analyses of RCTs did not show clear differences between the use of medical/surgical masks compared with N95/P2 respirators in healthcare workers when used in routine care to reduce respiratory viral infection risk. Five RCTs comparing N95 respirators to medical/surgical masks in prevention of laboratory-confirmed influenza favored medical/surgical masks though the results were not statistically significant (RR 1.10, 95%CI 0.90-1.34) (Jefferson et al. 2020). Most studies in these analyses examined viral pathogens other than COVID-19 (though some included patients with the closely related human beta-coronaviruses), and many of the studies had varying degrees of imprecision making it difficult to draw firm conclusions.
- Hand hygiene compared to control modestly reduced the burden of acute respiratory illness (RR 0.84, 95% CI 0.82-0.86). There were too few trials comparing different types of hand hygiene interventions to be certain of any true differences between soap and water, alcohol-based hand sanitizers or other types of interventions (Jefferson et al. 2020).
- No RCTs or observational studies have directly compared different combinations of these four strategies simultaneously (e.g. continuous medical masking plus hand hygiene vs continuous medical masking plus hand hygiene plus continuous eye protection: continuous medical masking and hand hygiene to continuous eye protection, or to contact and droplet PPE.)
- Three cluster-RCTs identified in the Jefferson et al. Cochrane review (MacIntyre et al. 2011, 2013, 2015) evaluated continuous masking of HCWs during the entire work shift, in high-risk settings (e.g. emergency department, respiratory wards), in reducing influenza-like illness. Two studies compared continuous N95 to continuous masks (MacIntyre et al. 2011, 2013) and one compared continuous masks to no masks (MacIntyre et al. 2015). All three studies found no statistically significant difference in influenza-like illness among HCWs. Two studies evaluated laboratory-confirmed influenza among HCWs and found no difference between continuous N95 and continuous masks (MacIntyre et al. 2011, 2013).
- Two before-after studies, identified in the WHO mask use guidance, found that implementation of a universal masking policy in hospital systems was associated with decreased risk of healthcare-acquired SARS-CoV-2 infection. These studies did not adjust for potential confounders, had no concurrent control group, had relatively short study periods and were not conducted in the context of COVID-19.
- No RCTs have compared eye protection with no eye protection (Verbeek et al. 2020, Jefferson et al. 2020). A pooled analysis of observational studies on MERS and SARS health care settings of lower quality (Chu et al.2020) identified a nearly 80% reduction in viral infection or transmission associated with the use of eye protection among HCWs.
- PPE use by patients in health care settings (either those with suspect or confirmed COVID-19, or those without COVID-19) has not been evaluated in high quality studies. It is important to note that HCW are protected from acquiring COVID-19 from patients with COVID-19 through their use of PPE, predominantly use of masks and potentially eye protection. Masking of patients therefore is a consideration primarily where roommates or visitors may be at transmission risk. There are guidelines that discuss patient masking in various healthcare contexts.

Research Question 4: Are there risks (to patient care, patient wellbeing, healthcare workers or adherence/behaviour) to the use of continuous PPE?

- There is extensive evidence (quantitative and qualitative) describing physical adverse effects from wearing PPE for long periods of time. Commonly described side effects of PPE include headache, adverse skin reactions, breathing difficulties, rhinitis and nasal symptoms, eye and ear discomfort, thermal stress, and visual field reduction. These symptoms were all described related to N95 masks, while only ear discomfort and skin reactions were commonly described with use of medical masks. Eye discomfort and visual field reduction were reported as a side effect of wearing both eye protection and any type of mask.

- Thermal stress was reported as a result of PPE that included a gown; however, these studies were often performed in hot or tropical climates and may not be as relevant a side effect in Alberta.
- The use of continuous PPE, or any strategy required increased PPE use may increase the risk of PPE fatigue, doffing errors and risk of self-contamination/self-inoculation. Therefore, PPE recommendations in excess of what is optimally required for protection may actually reduce compliance and increase the risk of breaches and errors
- The literature is heterogeneous, but the use of PPE and isolation precautions can be associated with communication challenges, and delirium in patients in isolation. Facial masking, impairs the ability of healthcare providers to communicate with patients and with other providers. Specifically, clinical and non-clinical studies reported impaired facial emotion recognition, hearing, speech discrimination and processing, speech intelligibility, and required increased vocal effort. These communication challenges limit the ability of providers and patients to comprehend each other, ability of providers to relate to their patients and to build a productive therapeutic relationship. However, continuous mask use is acknowledged as a near ubiquitous measure in the current pandemic. However, three systematic reviews show that care quality is not impacted by isolation precautions, although the authors of these reviews agree that the evidence is highly heterogeneous. The negative outcome most consistently associated with isolation precautions is delirium – isolated patients have significantly higher odds of experiencing delirium compared to non-isolated patients.
- The evidence for the effect of isolation on depression and anxiety in patients is mixed. Patient perceptions of care do not appear to be significantly affected by isolation precautions.
- Staff adherence to PPE guidance is complicated and appears to be influenced by multiple factors including PPE norms, physical discomfort, interference with ability to provide care, and interference with normal processes. One study suggested that a perception of adequate PPE (i.e. perception of safety) can mitigate non-adherence related to physical discomfort.
- No evidence was identified that described staff complacency with other protective behaviours due to full / continuous PPE; however, one study suggested that PPE may contribute to a false sense of security in staff.
- The time required, perceived inconvenience, and supply concerns associated with donning and doffing procedures may result in staff neglecting their own needs (such as fully utilizing breaks, eating, drinking, and using the toilet). These stresses, combined with physical discomfort and impaired communication, can impact mood and erode morale over time.

Research Question 5: Which care areas (e.g., ICU, emergency, perioperative care) pose the highest risk of COVID-19 exposure for healthcare workers?

- There are several observational studies, particularly cross-sectional studies that have examined the relative risk or association between areas of care and COVID-19 infection among HCW. The findings from these studies are mixed.
- Most of the included studies examined the risk of COVID-19 infection for HCWs working in designated COVID-19 wards; half of the studies reported increased risk (relative to non-COVID-19 wards) and half reported no difference in risk.
- Four studies reported that HCWs in the intensive care unit (ICU) were significantly less likely to test positive for COVID-19; one study identified no difference in risk of infection between HCWs in the ICU and acute care areas.
- The relative risk or association between other acute care areas (e.g., emergency department, acute medical wards) was heterogeneous, with included studies reporting increased or no association between such areas of care and HCWs acquiring COVID-19.
- Data from the AHS Workplace Health and Safety (WHS) Testing dashboard and the acute care outbreak dashboards from March 5 to August 31, 2020, suggest that occupational infections have occurred at a relatively low rate in comparison to many jurisdictions using current precautions, across a range of HCW staffing categories and care areas (see also the SAG review on risk of COVID-19 for healthcare workers). Additionally, from March 5 to December 9, 2020 the majority of healthcare employee and physician

infections (63%) were acquired in the community; 33% were workplace associated exposures but additional detail on location is not currently available (See AHS Tableau dashboard).

Committee Discussion

The review was discussed by the Scientific Advisory Committee on December 2, 2020 and December 9. Initial recommendations were around terminology, links, resources, and level of evidence. The committee agreed that N95 should not be recommended continuously based on extant data. The evidence base for current precautions (continuous masking and eye protection) was discussed and it was decided to frame this within Practical Guidance rather than Recommendations, given the limited evidence base. It was recognized that public health and operational decisions need to consider other contextual pressures (for example, reducing the number of HCW requiring quarantine), in addition to consider the quality of evidence available.

Patient masking was discussed in detail: it was emphasized that symptomatic or suspect/possible/confirmed COVID-19 patient masking for "source control" has not been evaluated in high quality studies. It was noted that it would seem to offer little added benefit where HCW are using continuous PPE but may be more relevant where patients are in shared rooms without adequate distancing, or where visitors are present. Given the lack of published studies this was suggested to be addressed in practical guidance.

Some members also noted that patients with deteriorating clinical status might need special attention, as a group where AGMP may be required with short notice and thus some latitude for HCW PPE selection in this situation was felt important. It was also discussed within written feedback whether there are specific HCW groups who perform repeated AGMPs in settings where symptom and risk assessment may be constrained who might be considered for continuous N95 use in select settings, if recommended by their local Infection Prevention and Control teams.

Finally, the committee reviewed and discussed local WHS data concerning occupational acquired COVID-19 infections among HCWs in the first wave of the pandemic. The committee agreed that the data was of a great value for broad reporting and decision-making in the province and that selected available data should be included in this review, as well as for a potential future review on its own. The findings from the WHS data analysis was also felt to be of value to address current research and data gaps and identify causes of facility outbreaks, which are required to better inform local PPE guidance.

Recommendations

Recommendation 1a: For suspect, probable and confirmed cases of COVID-19, in acute care and long-term care, we recommend that healthcare staff maintain current recommendations of contact and droplet precaution for suspect, probable or confirmed COVID-19 patient encounters,

Recommendation 1b: For patients or residents without COVID-19 compatible symptoms or who are COVID-19 negative in acute care and long-term care, the current evidence base supports that healthcare staff use continuous masking, careful hand hygiene and repeated comprehensive point-of-care patient risk assessments.

Note: Continuous eye protection for HCW and masking of patients or residents in acute or long term care is discussed under Practical Considerations

Rationale: 1a. No guidelines have recommended full PPE (contract/droplet) for all patient encounters, particularly those who are asymptomatic or are COVID-19 negative, and there is no current scientific evidence of additional benefit to healthcare workers from this practice. The data on potential harms identified in this review supports that continuous full PPE not be recommended.

Rationale 1b. Two before-after studies found that implementation of a continuous masking policy in hospital systems was associated with decreased risk of healthcare-acquired SARS-CoV-2 infection (Seidelman et al. 2020, Wang et al., 2020). These studies had limitations including no adjustment for potential confounders, no concurrent controls, and short study periods. Three cluster-RCTS evaluated continuous masking of HCW in reducing influenza-like illness risk with no significant differences found

(two studies evaluated continuous N95 compared to continuous masks, and one compared continuous masks with no masks). Given these limitations it is also noted that use of continuous masking (in combination with continuous eye protection – as noted in practical guidance) will reduce the number of staff requiring quarantine if they are exposed to a patient who was not suspected of having COVID-19 but subsequently tests positive.

Recommendation 2: N95 or similar respirators are not recommended as part of continuous general PPE, but are recommended for healthcare workers who anticipate performing an AGMP on a patient with confirmed COVID-19 infection or suspect COVID-19 infection based on a comprehensive point-of-care risk assessment.

- *Rationale:* No studies have evaluated the effectiveness of continuous use of N95s or other respirators compared to continuous medical masks. The evidence from a systematic review and meta-analysis of RCTs suggests that there is no clear difference between the use of medical masks compared with N95 or similar respirators in reducing respiratory viral infection in healthcare workers (Jefferson et al. 2020), although it is noted that these did not evaluate SARS-CoV-2 transmission. Continuous use of N95 even in the context of increased community transmission of any respiratory virus is not supported by current evidence. Risks to the wearer associated with the use of N95 or other respirators can be important (e.g. headache, breathing difficulties, impaired cognition) and lead to excess fatigue and distress at work.

Practical Considerations

Any modification to respiratory protective equipment mandates within the context of a pandemic must include several considerations beyond the level of evidence supporting their protective ability. Considerations should also include the risk of SARS-CoV-2 exposure according to the current understanding of the transmission of the virus and repeated point-of-care risk assessments, hospital outbreak status, the physical risks associated with their use among healthcare workers, the perception of PPE and behavioral impact on staff, and the impact of a continuous PPE mandate on non-healthcare staff (e.g., overall healthcare worker morale and psychological safety), and the access to and supply of PPE. Where the evidence base is insufficient to allow the Scientific Advisory Group to issue conditional recommendations, these considerations are reflected in Practical Considerations.

*Practical Consideration 1***.** For asymptomatic or COVID-19 negative patients in acute care, current AHS guidance now recommends that healthcare staff use continuous eye protection in addition to continuous masking, careful hand hygiene and ongoing comprehensive point-of-care risk assessments of patients.
The rationale supporting continuous eye protection is that while no RCTs have compared eye protection with no eye protection; a pooled analysis of observational studies of low quality (Chu et al. 2020) identified nearly 80% reduction in viral infection or transmission with the use of eye protection among HCWs, and this has also influenced Workplace health and Safety Risk assessments. High-quality evidence pertaining to the additive benefit of eye protection among HCWs is lacking. Although many jurisdictions currently recommend continuous masking among HCWs for the duration of their shift; a few jurisdictions (e.g. Manitoba, British Columbia) recommend eye protection in conjunction with continuous masking. The CDC guidance only recommends continuous eye protection with continuous masking only in the context of *moderate or substantial community transmission.* Recommendations from the Public Health Agency of Canada (PHAC) specifically mention a rationale to protect “staff and physicians and limit the need for workplace exclusions”. The AHS guidance states the use of “continuous use of eye protection for all healthcare workers involved in patient care, which includes all patient interactions that occurs within two metres (2 m). This includes both hands-on patient care, as well as indirect patient care such as meal delivery and housekeeping.” Workplace Health and Safety will no longer exclude workers who wore a mask and eye protection, but were not wearing gloves or a gown, at the time of their patient interaction [with an asymptomatic or COVID-19 negative patient] who subsequently is identified as a case with transmissible COVID-19 (applicable to scenarios where there was no AGMP exposure).

Practical Consideration 2. Patients with suspect, probable or confirmed COVID-19 in acute care and long-term care, are encouraged to wear a medical mask (if tolerated and with recognition of the patient’s medical condition) as a means of source control when they leave their room.

Outpatients with suspect, probable or confirmed COVID-19 should wear a medical mask (if tolerated and with recognition of the patient's medical condition) as a means of source control if within 2 metres of people not wearing appropriate PPE.
Use of a medical mask in other settings, including within a patient room, should be considered primarily based on the presence of individuals at risk (not wearing appropriate PPE, within 2m distance for an extended time) as is generally advised for all symptomatic persons.

Rationale: PPE use by patients in health care settings has not been studied. No studies were identified that evaluated the effectiveness of *continuous masking* of patients with or without COVID-19 in healthcare settings. There are guidelines that discuss patient masking in various healthcare contexts. For instance, the current AHS guidance indicates patients on contact and droplet precautions in acute care are asked to mask when leaving a patient room. Recent guidance from the WHO states that "in geographic settings of known or suspected community or cluster transmission of SARS-CoV-2 virus, universal masking (all persons [staff, patients, visitors, service providers and others] to wear a mask at all times except for when eating or drinking) should be advised in health facilities" (WHO 2020). Further, "inpatients are *not* required to wear a mask (medical or non-medical) unless physical distancing of at least 1 metre cannot be maintained (e.g. when being examined or visited at the bedside) or when outside of their care area (e.g. when being transported)", (WHO 2020). The WHO guidance does not indicate levels of community incidence or prevalence of SARS-CoV-2 to define "known or suspected community or cluster transmission of SARS-CoV-2."

A SAG review on mask use in the community reported that systematic reviews of RCTs failed to show significant benefit with medical mask use in community settings, whereas more observational and case-control studies (both at higher risk of bias), have suggested that masks are protective. Consequently, the SAG committee made several recommendations including "in the community, medical mask use should be prioritized for those with any symptoms suggestive of COVID-19, as a form of source control" and "In settings where social distancing cannot be maintained, medical masks or high-quality non- medical masks should be encouraged as a form of protection for those vulnerable to severe COVID-19 infection outcomes" (Asadi 2020).

Potential harms, concurrent treatments, health conditions (e.g. confusion) and practical limitations (e.g. feasibility, compliance), can complicate source control masking among patients in healthcare facilities so tolerability assessment is crucial. Given HCW PPE guidelines and restriction of visitors currently in place, it is unclear that significant benefit in transmission reduction could be realized from inpatients continuously masking in healthcare facilities except in defined circumstances (e.g. when inpatients with any symptoms suggestive of COVID-19 are outside their room).

Practical Consideration 3. Fears and uncertainties related to PPE use among healthcare workers may be mitigated by clear communication about the evidence base reviewed, guidelines and rationale for changing the guidelines. The provincial Infection Prevention and Control PPE Peer Safety Coaches program may be a practical and feasible solution to provide healthcare workers the tools and training necessary to appropriately apply the point-of-care risk assessment, avoid errors in donning and doffing PPE, and to recognize and mitigate situations of potentially high-risk exposures.

Practical Consideration 4. To enhance the PPE guidance and help address important research gaps, collaborations between data asset groups within AHS (e.g. Workplace Health and Safety, Infection Prevention and Control, public health and Analytics), the PPE Task Force, and the Outbreak Task Force should enable data sharing, consolidation and analysis. Collaborative investigations are required to identify risk factors and sources of transmission of SARS-CoV-2 in healthcare settings (including factors such as: AGMP related, HCW or patient as exposure source, PPE breaches (in PPE or technique, point of care risk assessment adequacy). These findings can inform evolving recommendation, be used in HCW education and further investigate whether outbreaks are influenced by different levels of community COVID-19 rates. It is suggested that these elements be reported to ECC as well as the PPE Taskforce.

Strength of Evidence

Question 1: Sixteen studies evaluating risk factors for COVID-19 outbreaks in long-term care were observational studies that were generally graded as low-moderate quality. Six of the studies which identified community transmission being associated with long-term care outbreaks were graded as high-quality observational studies, typically because analyses adjusted for known confounders. No studies examining the association between community transmission and outbreaks in acute care facilities were identified; however, three studies speculated the role of community transmission in acute care outbreaks and were described in the evidence synthesis. Use of local data to explore the relationship between community incidence of COVID-19 and hospital or LTC outbreaks carries many limitations and should be interpreted with caution.

Question 2: The grey literature search identified 27 Canadian and international guidelines, guidance documents, technical reports, and/or frameworks relevant to this question. Given that the search was targeted to websites of Canadian and international governments as well as well-recognized public health and health protection agencies, the included references are from credible sources. However, it is difficult to determine the quality of the included references for this question, as the methodological considerations for their development (e.g., expert consensus input, evidence synthesis and review) were not provided. Most of the included references were not referred to as "guidelines". Common mechanisms and tools to assess quality of guidelines (e.g., GRADE) are, therefore, difficult to apply.

Question 3: A significant number of RCTs, observational studies and systematic reviews and meta-analyses of these studies have evaluated the efficacy and effectiveness of masks, respirators and to some extent other types of PPE (e.g. eye protection). A total of 16 references were included, one being a recent Cochrane systematic review and meta-analysis (Jefferson 2020) on the effectiveness of physical interventions to disrupt respiratory viral transmission, which formed the foundation for this rapid review. However, uncertainty remains on the overall effects of using these interventions among healthcare workers and infected patients. The overall evidence was scored low-moderate quality since risk of biases were high or unclear. Common issues across clinical studies include different methods, outcomes, and confounding variables; many are underpowered. The quality and quantity of evidence on use of PPE, particularly respiratory protection, against SARS-CoV-2 is low. The paucity of evidence, low quality, indirectness and imprecision make it difficult to draw firm conclusions which can be generalized to the current COVID-19 pandemic.

Question 4: The literature was searched for qualitative and quantitative evidence that describes the experiences, behaviours, risks, and harms of healthcare workers and patients who are required to use PPE or are placed on contact/isolation precautions. Evidence pertaining to the quality of care provided to patients under isolation precautions, the perceptions of those patients, and qualitative evidence related to the experiences of healthcare workers during previous pandemics was generally of moderate-high quality as it was planned and conducted without the time pressures of COVID-19. Evidence pertaining to the physical discomfort of PPE, especially those findings from 2020, was generally of low-moderate quality. These studies were often cross-sectional surveys that were distributed online or through professional group messaging (e.g. WhatsApp) that had a high risk of response bias and recall bias. These studies are likely to overestimate the true severity or incidence of PPE-related physical harms, as those who experienced PPE-related harm are more likely to share or report on their experience.

More specifically, the included studies do not always clearly define the type of PPE being used, the duration, or the supporting guidance. This makes it difficult to identify what part of the PPE protocol is causing harm or resulting in reduced adherence. Further, there were very few studies that specifically discussed the risks of PPE or quality of care due to PPE in a pandemic setting, limiting the generalizability of the findings. It is possible that the findings are not translatable, as healthcare workers would not be continually donning and doffing their PPE between patients as is the case in a non-outbreak context.

Question 5: This rapid review of the evidence identified several primary studies of relevance to address this question. All were designed as observational studies: 12 cross-sectional studies (1 pre-print); 5 prospective cohort studies (2 were pre-print), 2 retrospective observational studies, 2 case control studies; and 1 study was described as an observational cohort study (also pre-print) that included a prospective cohort design and a cross-

sectional survey. These observational study designs are appropriate for assessing the relative risks or associations between areas of care and HCWs testing positive for COVID-19. Broadly, the quality of included studies ranged from low to moderate and with potential limitations relating to sampling bias, short study or observation periods, recall bias (for participant self-reported data), measurement bias, and reporting bias (incomplete data and methods reporting).

Limitations of this review

As this is a rapid review and evidence about COVID-19 is ever-changing, the included studies are not exhaustive. For feasibility of a rapid review, the writers/assists identified literature through the provided search strategies. In situations where limited evidence was identified through the initial searches, partial snowball searching was conducted, and the scope of searches was not expanded to identify additional sources. In some instances, the available literature included studies that have not been peer-reviewed (pre-print) or grey literature/jurisdictional reports. Overall, the body of literature in this area is missing information on PPE effectiveness and the impact of PPE use among healthcare workers and patients in the context of the pandemic.

Research Gaps

- The body of evidence gathered here does not provide an assessment of effectiveness of the addition of continuous eye protection, universal contact/droplet precautions (i.e. full PPE) or continuous N95 compared with continuous masking.
- Further investigations are needed to:
    - 1) examine the effectiveness of masks as source control (for symptomatic and asymptomatic patients) in healthcare settings;
    - 2) examine the effectiveness and harms of different levels of PPE used on the prevention of SARS-CoV-2 transmission;
    - 3) determine the relationship between different levels of community COVID-19 rates on the presence and size of outbreaks in healthcare settings; and
    - 4) to identify other risk factors and sources of transmission of SARS-CoV-2 in healthcare settings.
- Data from Workplace Health and Safety in AHS is comprehensive and robust. Outbreak investigations identifying HCW PPE use and breaches, COVID-19 exposures and HCW outcomes should be routinely reported and published.

Summary of Evidence

Research Question 1: Can the prevalence of COVID-19 in the community be used to predict the likelihood of healthcare-based outbreaks? If so, can levels of risk be identified that requirements for increased levels of PPE are triggered as community prevalence rises? How are risk levels impacted by the proportion of community cases with an unknown source?

For feasibility of a rapid review, a broad search strategy was applied to this question. It was designed to capture the body of literature related to outbreaks or clusters in various healthcare settings (e.g. long-term care, hospitals, and specialty units) and the association between these outbreaks with community levels of COVID-19. Abstracts that modeled healthcare utilization or hospital capacity but did not discuss impact on PPE directly were excluded as were studies that described outbreaks but did not indicate a role of community transmission. Given this approach, it is likely that observational studies, particularly those which measured and controlled for community prevalence or incidence in multivariate models were missed. No studies were identified which directly assessed the association between community transmission of COVID-19 and hospital outbreaks or nosocomial transmission. Additionally, only a few studies have described hospital nosocomial transmission (Zhou 2020, Lessells 2020). Given that long-term care or nursing homes have been particularly affected by the pandemic, many of the studies identified focused on these healthcare settings.

The primary search strategy resulted in 16 studies in LTC and 3 studies in acute care. Table 1 details the studies in LTC identified, followed by a narrative description of the acute care studies. See the PRISMA flow diagram (Appendix). Most of the LTC studies were identified from a rapid conducted by the National Collaborating Centre

for Methods and Tools (NCCMT) from McMaster University on the risk factors associated with COVID-19 outbreaks in long-term care (LTC) (NCCMT 2020).

According to the rapid review by NCCMT, across studies looking at risk factors associated with COVID-19 outbreaks, incidence in the surrounding community was found to have the strongest association with COVID-19 infections and/or outbreaks in LTC settings. They scored the *overall certainty of evidence as moderate* according to GRADE guidelines. The authors outline that in several studies, the association between organizational-level factors and risk of outbreaks or mortality was reduced or eliminated after adjusting for levels of community transmission. In studies that did not adjust for community transmission, risks of outbreaks or mortality varied considerably between geographic regions, which the reviewers indicate may be explained by variations in community transmission (NCCMT 2020).

Despite several observational studies demonstrating a relationship between community incidence or prevalence and long-term care outbreaks, no studies correlated increased community transmission of COVID-19 with changes in PPE requirements among staff. Furthermore, the studies did not always provide estimates of community transmission or clear-step wise comparisons of different transmission rates.

Table 1. Studies describing the relationship between community COVID-19 prevalence and long-term care outbreaks.

Author, Year	Population & Setting	Design & Study Period	Factors/Interventions	Methods	Outcome	Results	Quality
Li 2020	Nursing homes, US N=12,576	Cross-sectional, administrative data linkages May 25-31, 2020	**Independent variable**: % racial/ethnic minority residents categorized into quartiles Nursing home **covariates**; County-level covariates: total COVID-19 confirmed cases (minus NH cases); total number of COVID-19 deaths (minus NH deaths); Sociodemographic characteristics: pop size, % elderly, median household income, % high school ed, degree competition b/w NH	Multivariable analysis of # new COVID-19 cases and deaths Two-part models: 1st GLM – likelihood of at least one new confirmed case or death in the week 2nd: count model, estimated # NH new cases or deaths conditional on at least one new case or death	COVID-19 lab-confirmed new cases among residents, new deaths among residents, new cases among staff Others (binary outcomes): N95, surgical masks, face shields, googles, gowns, gloves, any PPE, ABHR	After controlling for NH, county and state covariates, and compared with NH in the low-proportion group: (aOR 1.25, 95% CI 1.03-1.51) for medium-proportion; aOR 1.44, 95% CI 1.14-1.82 for medium-high; 75% (aOR 1.76, 95% CI 1.38-2.25) for high proportion Supplement: Weekly new cases – residents: County Incidence: coef:0.0003797 (-0.0040612-0.0048206) p=0.867, (GLM also not significant) Weekly new cases – staff: coeff: -0.0017819, (-0.0100502-0064864, p=0.673)	Moderate
Temkin-Greener 2020	Assisted living facilities, n=3994	Cohort Up to 29 May 2020	AL-level characteristics, county-level laboratory-confirmed cases and deaths	Multivariable analysis 2 part, zero inflated models. 1st: GLM for likelihood of at least one confirmed case or death. 2nd: estimated # cases or death conditional on at least one new case or death. Controlled for AL covariates, total # cases and death per 1,000 population, state fixed effects	# of COVID-19 confirmed cases and deaths	After controlling for AL-level resident characteristics and county-level COVID-19 spread: Higher average resident age: aOR 1.05, p=0.001) Odds of a case higher in counties with higher COVID-19 rates (aOR 1.156, p<0.001). Among ALs with at least one case, greater county penetration of COVID-19 not associated with a higher case	High

Author, Year	Population & Setting	Design & Study Period	Factors/Interventions	Methods	Outcome	Results	Quality
						count in ALs with at least one positive case (IRR 1.002, 95% CI 0.99-1.02)	
Bui	Nursing homes, West Virginia, USA N=123	Cohort March-June 2020	**Independent variable:** overall star ratings **Confounders:** nursing home characteristics, county-level COVID-19 incidence (continuous cases per 100,000 population), average daily # of facility residents (continuous # residents per day). Variables rescaled by a factor of 10 (i.e. divided by 10).	Descriptive statistics Logistic regression	Outbreak (2+ lab-confirmed cases occurring within 14 days in a nursing home, with at least one of those cases being a resident)	Unadjusted analysis: Odds of outbreak increased by 5% for each additional 10 incidence cases per 100,000 in the county (OR 1.05, 95% CI 1.00-1.09) Higher county-level incidence between facilities with outbreak vs without outbreak (177.8 vs. 105.1 per 100,000) After adjusting for county-level COVID-19 incidence and # of facility residents, odds of COVID-19 significantly lower in higher quality nursing homes, based on star rating.	Moderate
Lipsitz 2020	Nursing homes, Massachusetts, USA N=360	Quasi-experimental	**Intervention**: Checklist, payment incentive, on-site and virtual IPC consultation, weekly webinars, continuous Q&A communication, PPE, staffing, testing resources. **Variables**: facility level data, county prevalence of COVID-19 infections, baseline total audit score	Hurdle mixed effects model (2-part models)	Changes in rates of new infections or deaths	Increased county prevalence associated with increased weekly infection and mortality rates (all p<0.0001).	Low
Shen 2020	Nursing homes, 7154 Medicare and Medicaid certified facilities, USA	Cross-sectional Up to July 2020	Facility characteristics County-fixed effects	OLS regression	Outbreak: Cumulative number of reported COVID-19 deaths per 100 beds	County level infection rates, in subsample of 8 states with data available. Outbreak sizes strongly related to county infection rate. 1 standard deviation inf average infection rate of staff towns is associated with additional 2.2 (p<0.001) or	Low

Author, Year	Population & Setting	Design & Study Period	Factors/Interventions	Methods	Outcome	Results	Quality
						2.4 deaths per 100 beds ($p<0.001$) at a facility.	
Dean 2020	Nursing homes, New York State, USA, n=355	Cross-sectional	**Independent variable**: healthcare worker union **Covariates**: nursing home, area-level characteristics, county-level data on confirmed cases of COVID-19 (cases per capita) (prevalence) and population	OLS both with and without adjustment for county- and facility-level variables.	% nursing home residents who died from COVID-19	COVID-19 cases per capita were associated with a 41.96 percentage point increase, but not statistically significant.	Moderate
Emmerson 2020	Residential or nursing homes, Wales N=3115 hospital discharges to 1068 facilities	Cohort 22 Feb to 27 June, 2020	**Independent variable**: Hospital discharge (time dependent covariate) **Other covariates**: size of home, services available, region (health board)	Cox proportional hazards regression model	Time to first COVID-19 outbreak (one resident testing positive for SARS-CoV-2 whilst resident or within 14 days of being resident.	Outbreak in 330 (30.9%) care homes. Health board largely mirrored regional size of the epidemic (marker of prevalence)	Moderate
Shi 2020	Nursing home residents, n=389, Boston	Retrospective cohort March -May 2020	Staff member's community of residence COVID-19 infection prevalence rate High infection rate: top decile of COVID-19 rates for the state ($\geq$1277 cases/100,000 persons) Clinical symptoms and outcomes Resident characteristics	Generalized estimating equations	Positive COVID-19 test	Staff residence in a community with high rate of COVID-19 significant predictor of disease: For every 10% increase in the number of staff who live in a high prevalence community, risk of testing positive for COVID-19 increased by 6% (aRR 1.06, 95% CI 1.04-1.08)	High
Sugg 2020	13,709 facilities USA	Cohort	Nursing home characteristics Housing socioeconomic and demographics of the county's population	Exploratory spatial data analysis 2-stage regression: 1st – GLM, nursing home data, county-level data 2nd: Generalized linear mixed effects, county and nursing home data	Cumulative COVID-19 resident cases (suspected and confirmed), COVID-19 resident deaths, COVID-19 staffing cases/deaths Rate ratios (cumulative incidence rate of COVID-19 cases in counties with a NH outbreak/incidence	COVID-19 rate (county): RR 1.83 (95% CI 1.70-1.97)	High

Author, Year	Population & Setting	Design & Study Period	Factors/Interventions	Methods	Outcome	Results	Quality
					rate of COVID-19 cases in countries without NH outbreak)		
Stall 2020	623 LTC, Ontario	Retrospective cohort	**Primary exposure**: profit status of LTC home, LTC home-level data, Cumulative incidence of COVID-19 in public health unit regions surrounding each LTC home (rate of COVID-19 per 1000 individuals)	Multivariable hurdle models 1st: logistic regression modeling home with 1 or more resident cases 2nd: extent of COVID-19 outbeaks and total number of residents using quasi-poisson regression with offset	COVID-19 outbreaks in LTC home (at least 1 resident case), extent of outbreaks (total number of confirmed cases among homes with outbreaks) and total number of COVID-19 resident deaths (among homes with outbreaks)	Cumulative incidence of COVID-19 in public health unit region surrounding the LTC home associated with odds of an outbreak (aOR 1.91, 95% CI 1.19-3.05; per increase in 1/1000 COVID-19 cumulative incidence) Cumulative incidence of COVID-19 in public health unit region surrounding the LTC home associated with extent of an outbreak (aRR 1.65, 95% CI 1.02-2.57)	High
Gorges 2020	Nursing homes, US N=13167	Cohort	**Independent variable**: Staffing levels **Covariates:** Facility level data County level characteristics: COVID-19 cases per 1000 residents (prevalence) divided into quintiles, metropolitan status	Multivariable logistic regressions; hurdle negative binomial-2 regression	Whether facilities had any COVID-19 cases (binary outcome) Among facilities with at least one case, size of outbreak (binary – did it meat threshold for outbreak - >1 confirmed case/10 certified beds; or >1 total confirmed and suspected cases per 5 certified beds or >10 deaths); and number of COVID-19 deaths (count variable)	County-level cases/residents: highest quintile compared to lowest quintile associated with odds of any case in NH: aOR 6.19 (SE 1.085, p<0.01) County-level cases/residents: highest quintile compared to lowest quintile associated with an outbreak in NH if at least one case: aOR 6.171 (SE 1.052, p<0.01). County-level cases/residents: highest quintile associated with 5.03 extra deaths (0.274	Moderate
Harrington 2020	Nursing homes, California,	Cross sectional	I**ndependent variable**: nursing hours per resident **Covariates:**	Logistic regressions	Facilities with COVID-19 residents compared with those	"logistic regression analysis showed similar patterns where RN hours below 0.75	Moderate

Author, Year	Population & Setting	Design & Study Period	Factors/Interventions	Methods	Outcome	Results	Quality
	N=1091		Ratings of nursing staff, facility-level characteristics, infection control violations, health deficiencies COVID-19 positive infection rates in LA county (highest number of cases – 341 per 100,000 population)		without COVID-19 residents	hprd and total nursing hours below 4.1 hprd were significantly related to increased probability of nursing homes having COVID-19 residents" No data provided. Adjusting for community transmission in model.	
Chatterjee 2020	Nursing homes, USA N=8943	Cross sectional 22-29 April 2020	Quality ratings, deficiencies, staffing, facility characteristics County-level rates of COVID-19 cases per 100,000 residents	Descriptive statistics	NH reporting COVID-19 cases vs NH did not report cases	Mean (SD) rates of COVID-19 were nearly twice as high in counties where facilities reported COVID-19 than in those without reported cases (428.2 [505.6] per 100,000 residents vs 231.3 [444.4] per 100,000 residents)	Moderate
White 2020	Skilled nursing facilities (SNF), n=3357	Cross sectional	Skilled nursing facility characteristics (demographics, quality) County level characteristics; county SARS-CoV-2 prevalence (confirmed cases per 100,000 population) and date of first case in county (SNFs in the top 5% of US counties as high prevalent counties)	Multivariate analysis, linear probability model with state effects.	4 facility level outcomes: at least one resident with SARS-CoV-2; # of confirmed cases per skilled nursing facility; facility level case fatality rate (cumulative deaths/cumulative cases); % residents testing positive	A difference of 1000 cases per 100,000 in the county (1% change) was associated with a 33.6 percentage point (95% CI 9.6-57.5 percentage point; p=0.008) difference in the probability of a SNF outbreak; associated with a difference of 12.5 SNF cases (95% CI 4.4-20.8, p=0.003)	High
Brown 2020	Nursing homes, Ontario, n=618	Retrospective cohort study 29 March – 20 May, 2020	**Independent variable**: Nursing home crowding (NH crowding index), **Covariates:** NH characteristics, resident characteristics at home-level, Incidence of COVID-19 in 35 public health regions surrounding NH (divided into quartiles), community size, health region population	Quasi-poisson regression for count outcomes, logistic regression, propensity score matching	Cumulative incidence of COVID-19 per 100 NH residents. COVID-19 deaths per 100 NH residents COVID-19 introduction (≥ confirmed COVID-19	Regional incidence, 4th vs 1st quartile associated with facility incidence: aRR 4.11, 95% CI 1.01-16.67	High

Author, Year	Population & Setting	Design & Study Period	Factors/Interventions	Methods	Outcome	Results	Quality
					resident case in a NH) as a negative tracer outcome		
Li 2 , 2020	Nursing homes, USA, n=215	Cross sectional Up to 16 April 2020	NH characteristics, staffing levels, quality, facility-level case mix Total number of confirmed COVID-19 cases other than NH cases (cases per 1000 population), county population size	Multivariable analyses 2-part models: 1st GLM for likelihood of NH having at least one confirmed case (or death) 2nd part: count model – poisson estimating number of cases or death conditional on at least one confirmed case (or death).	COVID-19 confirmed cases and deaths	County COVID-19 cases not in NH x 10 not associated with NH COVID-19 cases aOR 1.00 (95% CI 0.99-1.00)	Moderate

Acute Care Studies

For research question 1, no studies were identified that directly evaluated the association between community levels of COVID-19 and hospital outbreaks or nosocomial transmission. A recent rapid review and meta-analysis of nosocomial infections among patients with COVID-19, SARS and MERs identified only four studies describing nosocomial COVID-19 infections. Three were from Wuhan (1 case-control, 2 case series) and one from Hubei (case series) (Zhou 2020).

A few studies have indirectly assessed or speculated on the role of community transmission on hospital outbreaks. Jones et al. (2020) began a HCW screening program for SARS-CoV-2 in a teaching hospital in Cambridge UK over a 3 week and then a 4 week period from 6 April to 24 May 2020. HCWs were grouped into asymptomatic screening, symptomatic screening and symptomatic household contact screening arms. Positivity rates among individuals tested were compared in each arm between the two screening periods using Fisher's exact tests. Among the HCW symptomatic and HCW symptomatic household contact combined, 1.7% tests were positive and significantly lower than the 13% positive tests in the first period ($p<0.0001$). Similarly, the HCW asymptomatic screening arm also had a lower positivity rate in the second period (0.8% vs 3%, $p<0.0001$). The authors comment that the decline in positive HCW tests mirrored the decline in both patients testing positive at Cambridge University Hospitals NHS Foundation Trust and those tested throughout the wider region. This relationship is described through figures of positivity rates among HCWs, patients and the region. No inferential analysis was conducted to adjust for potential confounding factors (Jones 2020).

Sikkema et al. (2020) sought to understand sources and modes of transmission of SARS-CoV-2 in HCWs and patients in the same hospitals by combining epidemiological data with whole-genome sequencings of SARS-CoV-2 from clinical samples obtained from HCWs and patients in three different hospitals in the Netherlands. They performed a cross-sectional study at 2 teaching hospitals and 1 regional hospital. HCWs followed national PPE guidelines at the time of the outbreak, which included full PPE when encountering a suspected COVID-19 patient. No continuous masking protocol was mentioned. FFP2 masks were used during AGMPs. Among the 1796 HCW screened (15% of HCWs at these hospitals), 96 tested positive. Of these only 50 had complete SARS-CoV-2 genome sequences. 92% of the sequences from HCWs grouped in 3 clusters. Their epidemiological data, the presence of identical viruses in all three hospitals, and with non-hospitalized cases in other locations, indicated widespread community transmission with a local super-spreading event (carnival where 2/3 of HCWs tested positive participated in). Based on their analysis, infection of HCWs could have occurred through foreign travel, community contacts or nosocomial transmission. The authors concluded that no large-scale nosocomial transmission occurred in the context of not using continuous masking policies (Sikkema 2020).

Rickman et al. (2020) conducted a retrospective analysis to describe the epidemiological and clinical characteristics of hospital-acquired COVID-19 to inform knowledge of transmission and target IPC practices. Descriptive statistics were conducted. Definite and probably hospital-acquired cases were included over a 6-week period between 2 March and 12 April 2020. Throughout the period, multiple changes in IPC policies occurred. Staff PPE consisted of a minimum of gloves, apron, and surgical mask, with gowns, eye protection and filtering facepiece class 3 for aerosol-generating procedures. PPE was initially used for suspected or confirmed cases and extended to all patient interactions from 1 April. Of the 435 cases of COVID-19 inpatients, 66 (15.2%) were either definite or probable hospital-acquired infections. The case fatality was 36%. For 32% of infections, no source was identified, though likely could include asymptomatic or undiagnosed visitors, patients or staff members. Staff illness levels were high and surveillance testing of healthcare workers found that 27% of those infected were asymptomatic (Rickman 2020). The authors indicate that following the introduction of comprehensive IPC responses, both numbers and proportions of hospital-acquired cases fell. These IPC measures were not evaluated independently to determine their relative impact on cases. However, the authors conclude that expanded staff and patient testing, *use of PPE for all patient contacts*, enhanced IPC measures and cohorting of suspected cases, and *falling community incidence* contributed to the decline in cases (Rickman 2020).

Evidence from Local Alberta Data

Methods

In the following analysis, we examined the association of acute care and long-term care weekly outbreaks with COVID-19 incidence in the province in data collected during the period from 15 March to 21 November. Data were provided by Alberta Health Services. The dependent variables were either acute care or long-term care weekly outbreaks. The independent variables were weekly incidence rates categorized into 3 groups: <50, 50-<100, and ≥100 cases per week per 100,000 population. Zero-inflated negative binomial models were used to explore the association between different levels of community incidence and acute care or long-term care outbreaks and did not adjust for known confounding factors.

Results

Acute Care

A descriptive assessment of the data demonstrated that Calgary (n=23) and Edmonton (n=39) had the greatest number of outbreaks reported. The number of outbreaks per week in each AHS zone is highly skewed with inflated number of zeros, which increases the variance relative to the mean and over-dispersion is observed. The incident rate of community cases was highly correlated (r=0.949) with the active case rate (prevalence). Weekly incidence rates were used for this analysis since identifying incident cases provide more clarity than active cases, since recovery time would have to be considered and is currently difficult to ascertain from local data.

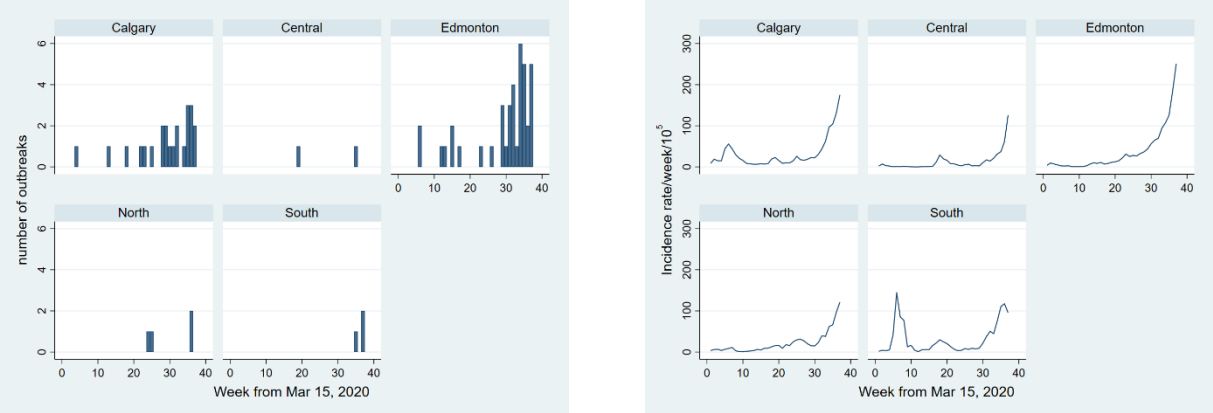

Figure 1. Hospital outbreaks (left panel) and COVID-19 incidence rates (right panel) by zone by week from 15 March to 21 November 2020.

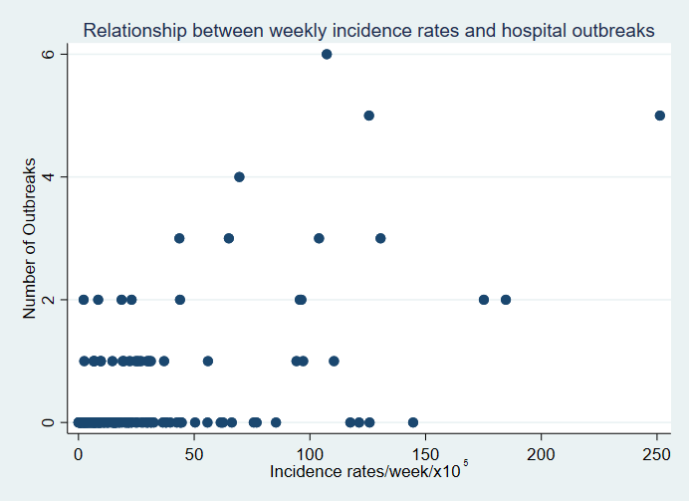

Figure 2. Relationship between weekly incidence rates and hospital outbreaks.

Figures 1 and 2 visually demonstrate a relationship between community incidence rates and the number of acute care outbreaks in Alberta. The number of outbreaks increases as the weekly incidence rates in the community increases. Particularly, when the incidence rate is above 50 cases per week per 100,000 population we begin to observe a larger number of outbreaks occurring.

An interesting phenomenon was observed in this unadjusted analysis. When compared to the base level (<50 cases per 100,000 population per week), the highest level of incidence rates (≥100) is not more likely as the intermediate level (50-100) to induce hospital outbreaks. When estimating the number of outbreaks per week in acute care hospitals in the province, we see that the higher the weekly incidence rates the higher number of outbreaks will occur in hospitals (increase when incidence rates rise from <50 to ≥100 cases per 100,000 per week (RR 8.52, 95% CI 4.96-14.63, p=0.000); representing an increase from 0.19 [95% CI 0.16-0.23] outbreaks to 2.2 [95% CI 0.69-3.80] outbreaks per week).

Long Term Care

A descriptive assessment of the data demonstrated that Calgary (n=80) and Capital Health (i.e. Edmonton) (n=55) had the greatest number of outbreaks reported. The number of outbreaks per week in each AHS RHA is highly skewed with inflated number of zeros, which increases the variance relative to the mean and over-dispersion is observed. The incident rate of community cases was correlated (r=0.765) with the active case rate (prevalence). The percentage of cases with unknown infection sources is not calculable due to the lack of information on RHA coding in the source data. Weekly incidence rates were used for this analysis since identifying incident cases provide more clarity than active cases, since recovery time would have to be considered and is currently difficult to ascertain from local data.

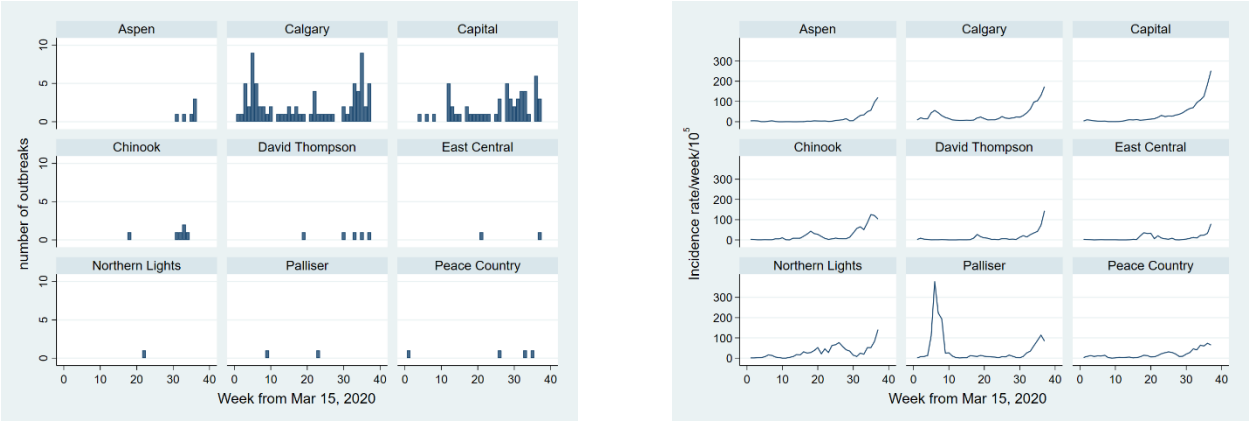

Figure 1. LTC outbreaks (left panel) and COVID-19 incidence rates (right panel) by RHA by week from Mar 15 to Nov 21, 2020

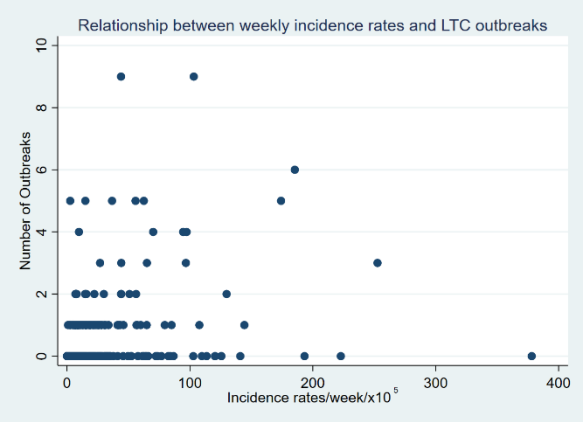

Figure 2. Relationship between weekly outbreaks in LTCs & COVID-19 incidence rates

In Figure 1 a bimodal peak of outbreaks is observed in Calgary, however a similar bimodal peak in the incidence rate per week in Calgary is not observed, as would be expected in LTC. Despite this, the number of outbreaks appear to increase as the weekly incidence rates in the community increases (Figure 2). Particularly, when the incidence rate is above 50 cases per week per 100,000 population we begin to observe a larger number of outbreaks occurring.

An interesting phenomenon was observed, like in the acute care analysis. When compared to the base level (<50 cases per 100,000 population per week), the highest level of incidence rates (≥100) is not more likely as the intermediate level (50-100) to be associated with LTC outbreaks. When estimating the number of outbreaks per week in LTC in the province, we see that the higher the weekly incidence rates the higher number of outbreaks will occur in LTC (increase when incidence rates rise from <50 to ≥100 cases per 100,000 per week (RR 2.79, 95% CI 2.28-3.41); representing an increase from 0.35 (95% CI 0.28-0.42) outbreaks to 0.93 (95% CI 0.50-1.35) outbreaks per week).

Limitations

Case reporting delays are known to exist for various reasons and data inconsistency existed across data sources. Data are cleansed and reconciled as much as possible on a best effort basis afforded. Separately, hospital and long-term care outbreak definitions may also have changed over time, with earlier outbreaks investigated but not formally reported as outbreak, thus rendering a potential underestimate in the number of outbreaks reported. Certain aspects of inconsistency and deficiency may still exist in the analytic data. The analysis nevertheless is

done in the spirit of conciseness and simplicity to meet the immediate need for information of the Scientific Advisory Group.

Research Question 2: What guidelines do other jurisdictions use to determine PPE requirements? Are there common features to these guidelines?

A grey literature search was completed to identify guidelines from other jurisdictions concerning the PPE requirements for HCWs in acute care and long-term care (LTC) settings during the COVID-19 pandemic. In brief, the websites of Canadian and international governments and well-recognized public health and health protection agencies were searched. A total of 27 guidelines, guidance documents, technical reports, and/or frameworks were identified (n=14 applicable to HCWs in acute care settings; n=9 specific to HCWs in LTC settings; n=4 applicable to HCWs in any healthcare settings). Complete details of these included references, as well as the recommendations for PPE requirements for HCWs in acute care and LTC settings, are provided in supplementary Tables 4 and 5, respectively.

Evidence from grey literature

The jurisdictional scan of guidelines among Canadian provinces and territories identified PPE guidance documents from British Columbia (BC Centre for Disease Control, 2020a, 2020b; Vancouver Coastal Health Authority 2020a, 2020b), Saskatchewan (Saskatchewan Health Authority [SHA] 2020a, 2020b), Manitoba (Shared Health 2020a, 2020b), and Ontario (Ontario Health 2020a, 2020b, 2020c; Public Health Ontario, 2020). Further, the Public Health Agency of Canada (PHAC) developed several infection and prevention control and/or PPE guidance documents in response to the COVID-19, three of which were also included for this review (PHAC, 2020a; 2020b; 2020c).

From international jurisdictions, national-level PPE guidance documents were identified from Australia (Government of Australia, 2020a; 2020b), New Zealand (New Zealand Ministry of Health, 2020), Korea (Korean Center for Disease Prevention and Control [KCDC], 2020), the United States (US Centre for Disease Control [CDC], 2020), and the United Kingdom (Public Health England et al., 2020). Documents intended to provide PPE guidance for multiple jurisdictions were produced by the European Centre for Disease Control (ECDC, 2020) and the World Health Organization (WHO, 2020a; 2020b; 2020c).

A summary of the recommended PPE requirements for HCWs treating acute care patients or LTC residents with COVID-19 from 7 of the included guidance documents is outlined in Table 2. These representative guidance documents were produced by either federal government, public health, and/or health protection agencies, are intended for national (or multiple) jurisdictions, and are commonly referenced in other jurisdictional PPE guidelines, including existing Alberta Health Services guidelines and resources.

Table 2. Summary of Canadian and International Guidance on PPE Requirements for Suspected or Confirmed COVID-19

PPE required with patients suspected or confirmed COVID-19 positive	Representative PPE Guidance and Recommendations						
	Public Health Agency of Canada	**Australia (Department of Health)**	**United Kingdom (Public Health England et al.)**	**World Health Organization**	**US Centers for Disease Control**	**European Centre for Disease Control**	**Korean Centre for Disease Control**
Direct patient care	• Mask • Long-sleeved cuffed gown • Gloves • Face or eye protection	• Medical mask* • Gowns/ Aprons • Eye protection • Gloves • Boot/shoe covers	• FRSM Type IIR • Disposable apron or gown, gown required if risk of spraying / splashing	• Medical mask • Gown • Gloves • Eye protection (goggles or face shield)	• N95 or equivalent or higher-level respirator or face mask** • Gown • Gloves	• Class 2 or 3 FFP respirators (FFP2 or FFP3) or face masks*** • Long-sleeved water-	• KF94 mask or equivalent respirator • Gown (long-sleeved, fluid-resistant gown) or

		• Head covers	• Disposable gloves • Eye/face protection (visor)		• Eye protection	resistant gown • Gloves • Goggles (or face shield)	coveralls with foot covers • Gloves • Eye protection (goggles or face shield)
Aerosol-generating medical procedures	• Fit-tested, seal-checked N95**** • Long-sleeved cuffed gown • Gloves • Face or eye protection	• PFR, such as a P2 or N95 respirator • Gowns/ Aprons • Eye protection • Gloves • Boot/shoe covers • Head covers	• FFP3 or Hood respirator • Disposable gown • Disposable gloves • Eye/face protection (visor)	• Respirator N95 or FFP2 or FFP3 standard, or equivalent • Gown • Gloves • Apron • Eye protection	• N95 or equivalent or higher-level respirator • Gown • Gloves • Eye protection	• A FFP3 respirator should be always used • Long-sleeved water-resistant gown • Gloves • Goggles (or face shield)	• KF94 mask or equivalent respirator, or PARP • Fluid-resistant gown or coveralls with foot covers • Gloves • Eye protection (goggles or face shield)
Continuous masking of HCWs throughout the duration of shifts in acute care or LTC settings	YES Medical mask	YES Medical mask in areas with *significant community transmission*	YES Medical mask Type II	YES Medical mask in the event of *any community transmission*	YES Medical masks preferred over cloth masks when available	YES Medical masks should be *strongly considered*	NA
Continuous masking of acute care patients or LTC residents (with symptoms of or confirmed COVID-19; source control)	YES – for acute care patients May be removed in private room Not required for LTC residents	Yes Medical mask, if tolerated	YES Medical mask (Type II or Type IIR), if tolerated and does not compromise their clinical care, such as when receiving oxygen therapy	YES Medical mask if tolerated	YES Cloth masks, if tolerated	YES Medical mask, if tolerated	NA

*In areas with significant community transmission, may consider a PFR instead of a medical mask if patients have cognitive impairment, unable to cooperate, or exhibiting challenging behaviours, or in wards where there are high numbers of suspected or confirmed COVID-19 patients

**In areas with no or low community transmission, use of medical masks is recommended if respirators are not available; In area with moderate to substantial community transmission, use of N95 or equivalent or higher-level respirator is recommended

***In case of shortage of respirators, the use of medical masks is recommended

****For long-term care facilities the use of a medical mask for AGMPs is a minimum requirement, use of N95 respirator should follow individual provincial or territorial guidance

AGMP: aerosol-generating medical procedure; FFP: face filtering piece respirator; FRSM: fluid-resistant surgical mask; HCW: healthcare worker; KF94: Korean filter 94 respirator; NA: not available from secondary source; PARP: powered air-purifying respirator; PFR: Particle filter respirator; PPE: personal protective equipment;

Common Features in COVID-19 PPE Guidance Across Jurisdictions

As summarized in Table 2, the recommended PPE requirements for HCWs in acute and LTC facilities are broadly similar across the representative guidance documents. Many of the recommendations appear to build off foundational infection prevention and control guidance already outlined by these agencies and provide additional guidance specific to the challenges faced by HCWs during the COVID-19 pandemic. Specifically, when providing direct care to acute care patients or LTC residents suspected (i.e., symptoms suggestive of) or confirmed to be COVID-19 positive, use of Droplet and Contact precautions are commonly recommended. At minimum, such precautions include the use of a medical mask, long-sleeved cuffed gown, gloves, and eye protection (e.g., visor, face shield or goggles). Exceptions to this minimum PPE standard were noted by the KCDC, which recommends use of a Korean filter 94 (KF94) respirator (or equivalent respirator, such as the US N95) instead of a medical mask (KCDC, 2020). Furthermore, the US CDC and the ECDC also first suggest the use of respirators (N95 and Class 2 or 3 Face filter piece (FFP2 or FFP3} respirators, respectively) and secondarily recommend medical masks in the event that respirators are in shortage or unavailable (US CDC, 2020; ECDC, 2020).

Similar minimum PPE requirements are recommended for HCWs performing aerosol-generating medical procedures (AGMPs) in acute care and LTC care settings. An AGMP is any procedure conducted on a patient or resident that can result in the production of aerosols of various sizes, including droplet nuclei. Examples of AGMPs may include intubation and related procedures (e.g., manual ventilation, open endotracheal suctioning), bronchoscopy, sputum induction, and non-invasive positive pressure ventilation (CPAP, BiPAP) (PHAC, 2020a). While most guidance documents note that for COVID-19 positive patients or residents AGMPs should be limited to those that are medically necessary, they should still be anticipated and appropriate precautions (including PPE requirements) planned for, when possible. As such, when performing an AGMP on acute care patients or LTC residents suspected or confirmed to be COVID-19 positive, the representative guidance documents commonly recommend that HCWs additionally employ Airborne precautions, which entail use of a respirator (instead of a medical mask), long-sleeve cuffed gowns, gloves, and eye protection (e.g., visor, face shield or goggles). Different types of respirators are recommended across the representative guidance documents. For instance, PHAC (2020a; 2020b; 2020c), the Australian Department of Health (Government of Australia, 2020a; 2020b), and the US CDC recommend use of N95 respirators (US CDC, 2020); whereas the UK's joint public health and health services guidance (Public Health England et al., 2020) and the ECDC (2020) recommend use of FFP3 respirators. In addition, the KCDC recommends use of either a KF94 or powered air-purifying respirator (PARP) (KCDC, 2020). These differences may reflect the availability and/or procurement of different respirator types in these jurisdictions, rather than specifically effectiveness of the respirators themselves. To this end, the WHO recommends use of either N95, FFP2, FFP3 or equivalent respirators for HCWs performing AGMPs (WHO, 2020a; 2020b; 2020c). In LTC settings, AGMPs may be performed less frequently than in the acute care setting and PHAC recommends that HCWs follow specific provincial and/or territorial guidance regarding use of either a medical mask or N95 respirator when performing AGMPs (PHAC, 2020c).

It is worth noting that the majority of the representative guidance documents recommend universal or continuous masking for HCWs in any healthcare settings throughout the duration of their shifts. In addition, and if tolerated, continuous masking of patients and residents suspected or confirmed to be COVID-19 positive, particularly in acute care settings, was also commonly recommended. This is consistent with current AHS practices (file:///C:/Users/jenine.leal/Downloads/hi-ipc-emerging-issues-ncov.pdf). Guidance varied with regards to the use of cloth versus medical masks for acute care patients or LTC residents. Both universal or continuous masking among HCWs and patients/residents were described as a means of "source control" in the context of the COVID-19 pandemic.

Continuous "full PPE", as in complete Contact and Droplet (or Airborne) precautions throughout HCWs shifts—including during non-patient facing activities—was not recommended in any of the included guidance documents (Tables 4 and 5 in the Appendix). Further, with regards to PPE requirements for direct care of patients or residents *without* suspected or confirmed COVID-19, recommendations varied across jurisdictions. For instance for HCWs in acute care and LTC settings in Canadian jurisdictions, guidelines from Manitoba recommend use of medical masks and eye protection; gowns and gloves are recommended "as per facilities' routine practices" (Shared Health 2020a, 2020b). Guidance from the Vancouver Coastal Health Authority in BC recommends HCWs use medical masks, eye protection, and gloves for patients and residents without symptoms and low-risk of

COVID-19 infection (VCH 2020a, 2020b). In contrast in Ontario, only medical masks are recommended at minimum for HCWs during patient-facing activities (Ontario Health, 2020a). However, across guidance documents the use of Standard Precautions and Point of Care Risk Assessment processes specific to the given jurisdictions was recommended when providing care to asymptomatic or COVID-19 negative patients and residents; a synthesis of these recommendations is provided in Table 4 and Table 5.

Along with the recommended PPE requirements, all of the guidance documents provided comments on appropriate application ("donning") and removal ("doffing") of PPE, or indicated other source documents for HCWs to refer to (Tables 4 and 5 in the Appendix). Recommendations related to the disposal or re-use (or extended use) of PPE, particularly in the context of PPE conservation during the COVID-19 pandemic, were frequently noted, although not consistently elaborated on in all of the guidance documents. PHAC, for example, notes that the guidance provided "does not address Canada's circumstances with respect to shortages of personal protective equipment (PPE) that are the subject of urgent and ongoing discussion at all levels across the country" (PHAC, 2020a). In contrast, one guidance document produced by the WHO specifically recommends rational use of PPE with respect to COVID-19 and considerations to minimize use of PPE during severe shortages (WHO, 2020b). See Tables 4 and 5 in the Appendix (in "Other Guidelines Comments" column) for extracted recommendations concerning disposal, re-use or extended use, where available.

Considering Levels of Community Transmission for PPE requirements

Guidance from two jurisdictional sources explicitly considered different levels of community transmission of COVID-19 when making their recommendations for PPE requirements. The Australian Department of Health recommends that in areas with *significant community transmission*, HCWs providing routine care in either acute care or LTC settings may consider use of a respirator instead of a medical mask if patients or residents exhibit cognitive impairment, are unable to cooperate, or exhibiting challenging behaviours, or are in wards where there are high numbers of suspected or confirmed COVID-19 patients (Government of Australia, 2020a; 2020b). Further, in areas *with significant community transmission* universal masking of HCWs throughout the duration of their shift is recommended when in any healthcare setting (Government of Australia, 2020a; 2020b). The US CDC also recommends that medical masks be used for routine care (and if respirators are not available) for areas with *no or low community transmission*, however, in areas with *moderate to substantial community* transmission, use of eye protection in addition to their medical mask is recommended (US CDC, 2020). What constitutes *low* versus *significant* levels of community transmission was not defined in either the Australian or US CDC guidance documents. The WHO does recommend universal masking of acute care and LTC HCWs throughout the duration of their shifts in the event of *any community transmission*, but does not specify particular levels of transmission (WHO, 2020a).

Research Question 3: What degree of protection is offered from universal masking in healthcare, including evidence for the utility of medical masks in preventing transmission from an infected person (source control)? What additional protection results from the sequential addition of a) continuous face shield/eye protection b) contact and droplet precautions c) continuous N95 mask use, each in comparison to continuous masking and hand hygiene?

Given the amount of literature on evaluating masks, the scope of the rapid review for this question was limited to systematic reviews, narrative reviews, scoping reviews and living reviews. The search strategy identified 1022 citations. These abstracts were pre-screened by an experienced rapid review writer and scientist (J Boyd) to identify relevant literature. Of these 81 were identified for inclusion. For feasibility of completing this rapid review, further screening was done to identify literature focusing on universal masking and/or overall PPE effectiveness in the context of viral respiratory infections. A total of 27 citations were prioritized for review. Upon inspection, one very recent systematic review and meta-analysis by the Cochrane Collaboration (Jefferson et al. 2020) was identified, which formed the foundation of evidence for this rapid review. No COVID-19 RCTs on PPE use and effectiveness were available at the time this was written. Other systematic reviews were investigated, and it was found that nearly all of them summarized or meta-analyzed studies that were included in the Cochrane review. From these, partial snowball searching was done to identify observational studies exploring the effectiveness of

different levels of PPE, particularly the use of universal masking. Table 6 in the appendix provides characteristics of reviews that were inspected. Results from the Cochrane systematic review, other reviews and individual studies are presented in Table 3 below.

The Cochrane systematic review and meta-analysis by Jefferson et al. assessed the effectiveness of physical interventions (screening at entry ports, isolation, quarantine, physical distancing, personal protection, hand hygiene, face masks and gargling) to interrupt or reduce the spread of acute respiratory viruses. Previous versions of this review have been published four times, with the more recent one in 2011, which included observational studies. For the 2020 update, the authors did not include observational studies as there were enough RCTs to address their study objectives. The pooled results of the RCTs, which were all in the context of seasonal and epidemic influenza, did not show a clear reduction in respiratory viral infection with the use of medical/surgical masks. There were no clear differences between the use of medical/surgical masks compared with N95/P2 respirators in healthcare workers when used in routine care to reduce respiratory viral infection. Hand hygiene modestly reduced the burden of respiratory illness. Harms associated with physical interventions were under-investigated. *No RCTs were found on eye protection, gowns and gloves, or PPE use, relevant for this review* (Jefferson et al. 2020).

Three cluster-RCTs were identified in the Jefferson et al. review which evaluated continuous masking among healthcare workers, in high-risk settings where multiple exposures to respiratory infections were expected, to reduce the risk of viral respiratory illness (MacIntyre 2011, 2013, 2015). Two studies compared continuous masking with continuous N95, and one compared continuous masking with no masks. One study assessed the risk of influenza-like illness only (MacIntyre et al. 2015), while two studies (MacIntyre et al. 2011, 2013) assessed clinical respiratory illness (CRI), influenza-like illness (ILI) and laboratory-confirmed influenza. No statistically significant differences between continuous N95 and continuous masking was identified: CRI RR 0.62 (95% CI 0.28-1.35) and RR 0.70 (95% CI 0.35-1.40); ILI RR 0.52 (95% CI 0.10-2.58) and RR 1.04 (95% CI 0.26-4.10); laboratory-confirmed influenza RR 0.31 (95% 0.07-1.32) and RR 2.61 (95% CI 0.12-58.93) in MacIntyre et al 2011 and 2013 respectively. Similarly, MacIntyre et al. (2015) did not find a statistically significant difference in ILI among HCWs when comparing continuous masks to usual practice (RR 0.26, 95% CI 0.03-2.51).

Randomized control trials are acknowledged as important standards for evidence-based decision-making in medicine since their design reduces biases, making them more reliable assessments of the effectiveness of interventions or treatments. However, despite the several RCTs evaluating masks, uncertainty remains about the effects of medical masks. The evidence was scored low-moderate quality since the risk of bias for the RCTs and cluster-RCTs was high or unclear. Many studies were conducted during non-epidemic influenza periods, but many were done during the global H1N1 influenza pandemic, and others during epidemic influenza seasons up to 2016. Therefore, studies were done during periods of lower respiratory viral circulation and transmission compared to COVID-19. The authors conclude that there was a high risk of bias in the trials, outcome measurement varied, and there was overall low compliance with the interventions during the studies making it difficult to draw firm conclusions which can be generalized to the current COVID-19 pandemic (Jefferson et al. 2020).

Other recent systematic and narrative reviews comparing effectiveness of respirators vs masks against common viral respiratory infections come to similar conclusions that both devices offer comparable protection in healthcare settings.

Two before-after studies, referenced in the WHO mask guidance, found that implementation of a universal masking policy in hospital systems was associated with decreased risk of healthcare-care acquired SARS-CoV-2 infection. Seidelman et al. (2020) used negative binomial regression to compare the incidence rates of healthcare-acquired SARS-CoV-2 cases among Duke Health HCWs before and after introducing universal masking using a likelihood ratio test. From March 15-June 6, 2020 they assessed all HCWs who tested positive for SARS-CoV-2 and observed a significant decrease in the cumulative incidence rate of healthcare-acquired SARS-CoV-2 infection among HCWs (LRT 4.38, p=0.03) one week after the implementation of universal masking on March 31, 2020 (Seidelman et al. 2020).

Wang et al. (2020) assessed the association of hospital masking policies with the SARS-CoV-2 infection rate among HCWs in Mass General Brigham. In March 2020, they implemented a multipronged infection reduction strategy involving systematic testing of symptomatic HCWs and universal masking of all HCWs and patients with surgical masks. They identified 3 phases during the study period: pre-intervention period (March 1-24, 2020), a transition period (March 24-April 5, 2020), a lag period to allow manifestation of symptoms (April 6-10) and an intervention period (April 11-30, 2020). During the pre-intervention period, the SARS-CoV-2 positivity rate increased exponentially from 0-21.32%, and during the intervention period it decreased linearly from 14.65% to 11.46%, with a net slope change of 1.65% (95% CI 1.13-2.15%, p<0.001) more decline per day compared with the pre-intervention period.

Neither study controlled for confounders or other interventions such as restrictions on elective procedures, social distancing measures, and increased masking in public spaces (Wang et al. 2020). Additionally, no concurrent control was included and the observed decreases in HCW infections occurred too quickly to be attributable to the universal masking policy (WHO 2020).

Source Control

Few studies assessed the effect of PPE use, particularly masks, among infected individuals (source control). A systematic review by MacIntryre and Chughtai (2020) identified 5 randomized control trials evaluating the use of masks among sick patients (source control) (Johnson et al 2009, Canini et al. 2010, MacIntyre 2016 et al., Barasheed 2014 et al., Leung 2020 et al.). The summary of these studies is taken verbatim from the MacIntyre, Chughtai review and are included in Table 6.

The Johnson 2009 studies was an experimental study of 9 influenza patients, which did not measure clinical endpoints. Participants with confirmed influenza coughed onto culture medium wearing a N95 respirator or masks. No influenza was measured on the medium (Johnson et al. 2009). Canini 2010 conducted a cluster randomized control trial of 105 symptomatic sick patients wearing a mask (or no mask) in the household and found no significant differences between arms. However, the trial was terminated prematurely, so it was likely underpowered (Canini et al. 2010). Barasheed et al. (2014) conducted a randomized control trial among Hajj pilgrims, with both well and sick pilgrims wearing masks in the tents randomized to “supervised mask use’ and compared to those well and sick pilgrims randomized to the “no supervised mask use”, and low rates of ILI were reporting among contacts of masked pilgrims (Barasheed et al. 2014). MacIntrye et al. (2016) conducted the largest available randomized controlled trials with clinical endpoints, studying 245 patients randomized to mask or control. Compliance was suboptimal in the mask group and some controls wore masks. The intention to treat analysis showed no difference in rates of clinical respiratory illness (RR 0.61, 95% CI 0.18-2.13), ILI (RR 0.32, 95%CI 0.03-3.13) or laboratory confirmed viral infections (RR 0.97, 95%CI 0.06-15.54). When analyzed by actual mask use, the rate of clinical respiratory illness in household contacts was lower in those who wore masks (RR 0.22, 95% CI 0.06-0.86). Risks of ILI and laboratory-confirmed viral respiratory infections were also lower in the mask group, but the difference was not statistically significant. (MacIntyre et al. 2016). Finally, a trial with an experimental design by Leung et al (2020) examined several viruses including seasonal human coronaviruses. It showed that coronaviruses are preferentially found in aerosolized particles compared to large droplets and could be expelled by normal tidal breathing. Wearing a surgical mask prevented virus from being exhaled (Leung et al. 2020).

Clinical trials evaluating the effectiveness of medical masks as source control are scarce, and therefore lower levels of evidence, particularly from laboratory studies, provide further guidance. Zhang et al. (2020) Twelve laboratory studies were identified and summarized. Most studies show high filtration capacity for both masks and respirators. *The authors comment that source control with masks may be superior to exposure prevention by either respirators or masks.* Although these studies provide information on the theoretical performances of respiratory protection devices, the experimental process and particle sizes tested may not resemble natural respiratory activity (Zhang et al. 2020). Many studies suffer from major limitations and inconsistencies in design and more importantly fail to account for clinical and behavioural factors.

Additional protection above universal masking

No studies were identified during this rapid review that have evaluated the incremental benefit of additional PPE with the use of continuous masking. In some jurisdictions, HCWs are instructed to wear eye protection in addition

to masks, however very few studies have examined the combined effects of overall PPE (Zhang et al. 2020). Recently, a an updated Cochrane systematic review and meta-analysis (Verbeek et al. 2020) was conducted to evaluate which type of full-body PPE and which method of donning or doffing PPE have the least risk of contamination or infection for HCWs, and which training methods increase compliance with protocols. Earlier versions were published in 2016 and 2019. In the update they included 24 studies, 2278 participants, of which 14 were randomized controlled trials, one quasi-RCT and nine had a non-randomized design (Verbeek et al. 2020).

In this review, only one study examined the effectiveness of different types of PPE, particularly the effectiveness of powered, air-purifying respirator with coverall compared to N95 mask and gown. The study found that the use of PAPR with coverall may protect against the risk of contamination better than a N95 mask and gown (RR 0.27, 95% 0.17-0.43) but was more difficult to don (non-compliance: RR 7.5 95% CI 1.81-31.1). Most other studies explored the relative effect of modified PPE designs compared to standard PPE (e.g. sealed gown and glove combination vs standard gown glove, gowns vs aprons; permeable but breathable vs permeable, not breathable attire). Eighteen of the studies did not assess healthcare workers who were treating infected patients but simulated the effect of exposure to infection using fluorescent markers or harmless viruses or bacteria (Verbeek et al. 2020).

No studies were found that investigated goggles or face shields. It was unclear from the study results about the best way to remove PPE after use and the best type of training in the long term.

In another systematic review and meta-analysis of observational studies by Chu et al (2020), the objective was to investigate the effects of physical distance, face masks, and eye protection on virus transmission in healthcare and non-healthcare settings. Most studies reported on bundled interventions, including different components of PPE and distancing, which was usually addressed by statistical adjustment. All studies were observational and occurred during recurrent or novel outbreak settings of COVID-19, SARS or MERS. The authors identified 13 unadjusted and 2 adjusted studies, which demonstrated eye protection was associated with lower risk of infection (unadjusted RR 0.34 95% CI 0.22-0.52, adjusted OR 0.22 95% 0.12-0.39) (Chu et al. 2020).

Samaranayake 2020 reviewed data on the effectiveness and efficacy of face masks and respirators, including protective eyewear, with emphasis on dental healthcare and excluded studies with high-risk of bias according to the Newcastle-Ottawa scale. They identified five studies that examined the use of protective eyewear against respiratory droplets and bioaerosols using simulated models or laboratory studies. Three studies found that either a face mask or fit-tested N95 respirator with eye protection provided better protection and that face shields alone cannot be used as a substitute for respiratory protection. Two studies looked at face fit factor and found that a conventional visor worn in the inverted position provides superior protection than wearing a mask without a visor; and secondly that face shields were substantially inferior to masks in obviating penetration of airborne debris because of a lack of peripheral fit.

Interestingly, a research letter by Bhaskar and Arun (2020), recently described transmission in a community setting before and after the use of face shields. Community health workers from a research network in Chennai, India counseled asymptomatic family contacts of patients tested positive for SARS-CoV-2 at their residents. These workers were housed in separate rooms of hostels, provided food, were not allowed to visit homes or public places outside of work, they communicated by phone, and traveled in small vans with a steel partition between the driver and back cabin. Workers wore masks in the van and maintained other levels of PPE when visiting households (i.e. 3-layered surgical masks, gloves and shoe covers) and used alcohol-based hand rub. The study began on 3 May 2020 and by 20 May 2020, face shields were added to their PPE. The researchers compared the number of positive tests (among households and workers) before and after the introduction of face shields. Before the introduction of face shields, 12 (19%) of workers developed COVID-19 infections. Of the 50 workers that didn't develop infection and went on to wear face shields, no workers developed COVID-19 infections. The authors suggest that face shields may have reduced ocular exposure or contamination of masks/hands or diverted movement of air around the face, thus reducing risk of infection given that no other known source of infection were identified, and workers had limited community exposure. However, although interesting, it is prudent that caution be taken when interpreting this report since full study design and methods weren't reported, it was a before-after study design without adjustments for multi-level confounding factors and

documentation of other potential exposures was not provided (e.g. asymptomatic contacts of SARS-CoV-2 patients) (Bhaskar and Arun 2020).

Table 3. Summary of Results from Systematic Reviews and Independent Primary Studies

Primary Study Author, Year and Country (Systematic Review Author, Year if applicable)	Patient/Population	Setting/Design	Intervention & Comparator	Outcome	Relative Effect (95% CI)	Quality	Notes
	Medical/Surgical vs No Masks; HCWs+Community; HCWs Only						
Jefferson 2020, Cochrane Collaboration UK	HCWs & Community (2 HCWs, 7 community) N=3507	9 trials total (8 cluster-RCTs)	Medical/surgical masks vs no masks	Viral respiratory illness (ILI)	RR 0.99 (0.82-1.18)	Low (GRADE)	Cochrane Review
	HCWs only N=1070	2 trials (subset of 9)	Medical/surgical masks vs no masks	Viral respiratory illness (ILI)	RR 0.37 (0.05-2.50)		
	HCWs & Community N=3005	6 trials (subset of 9)	Medical/surgical masks vs no masks	Laboratory-confirmed influenza	RR 0.91 (0.66-1.26)	Moderate (GRADE)	Cochrane Review
	N95 respirators vs medical/surgical masks; HCW+Community; HCWs Only						
	HCW & Households (4 HCW, 1 Household) N=8407	5 trials total	N95/P2 respirators vs medical/surgical masks	Viral respiratory illness (ILI)	RR 0.82 (0.66-1.03)	Low (GRADE)	Cochrane Review
	HCW & Households (4 HCW, 1 Household) N=7779	3 trials (subset of 5)	N95/P2 respirators vs medical/surgical masks	Clinical respiratory illness	RR 0.70 (0.45-1.10)	Very Low (GRADE)	Cochrane Review
	HCW & Households (4 HCW, 1 Household) N=8407	5 trials total	N95/P2 respirators vs medical/surgical masks	Laboratory-confirmed influenza	RR 1.10 (0.90-1.34)	Moderate (GRADE)	Cochrane Review

	HCWs only N=7799	3 trials	N95/P2 respirators vs medical/surgical masks	Clinical respiratory illness	RR 0.70 (0.45-1.10)		
	HCWs only N=8221	4 trials	N95/P2 respirators vs medical/surgical masks	Viral respiratory illness (ILI)	RR 0.81 (0.59-1.11)		
	HCWs only N=8221	4 trials	N95/P2 respirators vs medical/surgical masks	Laboratory-confirmed influenza	RR 1.05 (0.79-1.40)		
	Schools, Childcare centres, homes, offices N=44,129	7 RCTs	Hand hygiene vs. control	Acute respiratory illness	RR 0.84 (0.82-0.86)	Moderate (GRADE)	
	Schools, Childcare centres, homes, offices N=32,641	10 RCTs	Hand hygiene vs. control	ILI	RR 0.98 (0.85-1.13)	Low (GRADE)	
	Schools, Childcare centres, homes, offices N=8332	8 RCTs	Hand hygiene vs. control	Laboratory-confirmed influenza	RR 0.91 (0.63-1.30)	Low (GRADE)	
	Schools, Childcare centres, homes, offices	16 RCTS	Hand hygiene vs. control	Composite of ARI, ILI, influenza	RR 0.89 (0.84-0.95)	Low (GRADE)	
	Households, university residences, community N=4504	6 RCTs	Hand hygiene + medical/surgical masks vs control	ILI	RR 1.03 (0.77-1.37)		
	Households, university residences, community N=3121	4 RCTs	Hand hygiene + medical/surgical masks vs control	Laboratory-confirmed influenza	RR 0.97 (0.69-1.36)		
	Households, university residences, community N=2982	3 RCTs	Hand hygiene + medical/surgical masks vs hand hygiene	ILI	1.03 (0.69-1.53)		

	Households, university residences, community N=2982	3 RCTs	Hand hygiene + medical/surgical masks vs hand hygiene	Laboratory-confirmed influenza	0.99 (0.69-1.44)		
Bartoszko 2020, Canada	HCWs N=4453	RCTs, cluster-RCT 4 studies	Medical masks vs N95/FFP2	Laboratory confirmed viral respiratory infection	OR 1.06 (0.9-1.25)	Low (GRADE)	Systematic review & meta-analysis
Bartoszko 2020, Canada	HCWs N=4453	RCTs, cluster-RCT 4 studies	Medical masks vs N95/FFP2	Laboratory confirmed influenza infection	OR 0.94 (0.73-1.20)	Low (GRADE)	Systematic review & meta-analysis
Bartoszko 2020, Canada	HCWs N=4453	RCTs, cluster-RCT 4 studies	Medical masks vs N95/FFP2	ILI	OR 1.31 (0.94-1.85)	Very Low (GRADE)	Systematic review & meta-analysis
Bartoszko 2020, Canada	HCWs N=4007	RCTs, cluster-RCT 3 studies	Medical masks vs N95/FFP2	Clinical respiratory illness	OR 1.49 (0.98-2.28)	Very Low (GRADE)	Systematic review & meta-analysis
Ionnone 2020, Italy	HCWS N=1420	RCTs, cluster-RCT 2 studies	N95 vs surgical masks	Clinical respiratory illness	RR 0.43 (0.29-0.64)	Low (GRADE)	Systematic review & meta-analysis
Ionnone 2020, Italy	HCWS N=3937	RCTs, cluster-RCT 4 studies	N95 vs surgical masks	ILI	RR 0.72 (0.38-1.37)	Very Low (GRADE)	Systematic review & meta-analysis
Ionnone 2020, Italy	HCWS N=1866	RCTs, cluster-RCT 3 studies	N95 vs surgical masks	Lab-confirmed respiratory viral infections	RR 0.84 (0.52-1.34)	Very Low (GRADE)	Systematic review & meta-analysis
Ionnone 2020, Italy	HCWS N=2792	RCTs, cluster-RCT 2 studies	N95 vs surgical masks	Lab-confirmed respiratory infection	RR 0.73 (0.4-1.33)	Very Low (GRADE)	Systematic review & meta-analysis
Ionnone 2020, Italy	HCWS N=3937	RCTs, cluster-RCT 4 studies	N95 vs surgical masks	Lab-confirmed influenza	RR 1.07 (0.83-1.39)	Very Low (GRADE)	Systematic review & meta-analysis
Observational Studies							
Chu 2020	172 studies total N=2647 (10 adjusted studies) N=10 170 (29 unadjusted studies)	Observational	Face mask vs no face mask	Laboratory confirmed or probable infection	aOR 0.15 (0.07-0.34) unadjusted RR 0.34 (0.26-0.45)	Low (NOS)	
Chu 2020	172 studies total N=3713 (13 unadjusted studies)	Observational	Eye protection vs no eye protection	Laboratory confirmed or probable infection	Unadjusted RR 0.34 (0.22-0.52)	Low (NOS)	

					aOR 0.22 (0.12-0.39) aRR 0.25 (0.14-0.43)		
Liang 2020	15 studies	Case-controls and cohort	Facemasks (N95 or surgical mask) vs control	Laboratory-confirmed respiratory viral infection	OR 0.24 (0.15-0.38)	13 High-Score 2 Moderate Score quality (NOS Score)	Systematic review & meta-analysis
Zhang 2020, China	3 studies	2 Case-control 1 and cohort	N95 vs facemasks	Laboratory-confirmed respiratory infection	Cohort OR 0.43 (0.03-6.41) Case-control OR 0.91 (0.25-3.36)		
Loeb 2009, Canada (Ramaraj 2020, UK)	8 Canadian hospitals N=446	Cohort	Fluid repellent surgical mask vs N95	Respiratory symptoms, Laboratory-confirmed influenza	*No significant difference in infection rates	Low (GRADE)	Rapid Review, no summary estimate
Ng 2020, Singapore (Ramaraj 2020, UK)	1 Singaporean hospital N=41	Case report	Fluid repellent surgical mask vs N95	Laboratory-confirmed SARS-CoV-2	No confirmed SARS-CoV-2 cases -efficacy difference between groups not confirmed	Very Low (GRADE)	Rapid Review, no summary estimate
Loeb 2004, Canada (Ramaraj 2020, UK)	2 Canadian hospitals N=43	Retrospective	Fluid repellent surgical mask vs N95 vs no mask	Retrospective recall of SARS symptoms	80% reduction in risk of infections using mask vs no mask, no difference between mask types	Very Low (GRADE)	Rapid Review, no summary estimate
Chughtai 2018 (Licina 2020)	HCW N=10	Observational Simulation	PAPR vs N95	Self contamination (UV light)	Not estimable	Very Low (GRADE)	Primary Study from Systematic Review
Zamora 2006 Canada (Verbeek 2020, Licina 2020)	Healthcare staff volunteers N=50	Simulation Study, 1 cross-over RCT	PAPR + Coverall vs. N95 mask + gown	Any contamination (fluorescent marker)	RR 0.27 (0.17 to 0.43)	Very Low (GRADE)	Primary Study from Cochrane Review, Systematic Review
Source Control							
Barasheed 2014,	Hajj Setting (Community), Saudi Arabia N=164 Source control, well and sick pilgrims	Cluster RCT	Tents randomized to supervised mask use vs. no supervised mask use	Laboratory confirmed ILI	RR 0.58 (0.32-1.04)		
Canini 2010, France	Household contacts N=306	Cluster RCT	Surgical mask vs no mask	ILI	RR 1.03 (0.52-2.00)		

	Source control, Sick patients wearing mask (or no mask) in household				(terminated early)		
Leung 2020	Patients with acute respiratory illness (coronavirus, influenza, rhinovirus) N=246	Laboratory test	Face mask vs No face mask	Amount of respiratory virus in exhaled breath, Respiratory virus transmission	Frequency of detection of virus (droplet particles 30% vs 0%, p=0.09); Aerosol particles 40% vs 0%, p=0.04		
Johnson 2009, Australia	Subjects with confirmed influenza in ED N=9	Cross-over randomization (Each coughed 20x total -before control (no mask); with N95; with surgical mask; after control (no mask) N95 and mask randomized	Medical mask vs N95	PCR-detectable influenza (participants coughed 5x onto petri dish wearing each device)	Viral load: 0 copies/mL of influenza when using N95 and mask; 50,000 copies/mL in before and after control		
Liang 2020	Non-HCWs (pilgrims, household, students, population) N=8 studies, n=3820 participants	RCTs, observational studies	Facemasks vs control	Laboratory-confirmed respiratory viral infection	OR 0.34 (0.23-0.49)		

Research Question 4: Are there risks (to patient care, patient wellbeing, healthcare workers or adherence/behaviour) to use of continuous PPE?

Fifty-nine studies were included in the narrative synthesis below. No pre-print studies were identified. Five studies could not be retrieved in time for full text screening and inclusion in this review, however, it is unlikely that they include different information from the included studies. Of the included studies, 6 systematic reviews were included; 14 observational (prospective or retrospective cohort) studies were included; 2 case-control studies were included; 26 cross-sectional surveys were included; 3 non-clinical studies were included; and 8 qualitative studies were included. No grey literature was included in this review. The evidence was extracted verbatim from the article text; the full extraction table is included in the appendix as Table 7. For the present review, studies were included that had risks and harms of PPE / isolation precautions as both primary and secondary outcomes.

A living systematic review of the effectiveness of masks on HCW and community members that has been updated throughout 2020 found that evidence of the harms and risks of PPE associated with masking was limited at best, beyond acknowledgement of physical discomfort, breathing difficulties and skin events (Chou et al., 2020). In addition to the risks of full / continuous PPE to patients and providers, the impact on auxiliary staff should be considered as well. Corley, Hammond & Fraser (2009) suggest that during the H1N1 pandemic in Australia, staff were concerned about the additional waste and laundry needs of using continuous or full PPE and how these might affect the workload and stress of environmental staff.

Six categories were identified that relate to the risks of a full PPE / continuous PPE mandate:

- Physical effects of PPE on the healthcare provider
- Effects of PPE on communication and the therapeutic relationship
- Impact of PPE and isolation on care quality
- Patient experience and perceptions of PPE and isolation precautions
- Effects of PPE on healthcare provider behaviours

Physical effects of PPE

There was extensive evidence that wearing PPE for long periods of time causes physical discomfort and adverse effects. In addition to numerous studies specifically describing the dermatological, respiratory, and other effects of PPE, the discomfort and effect of long wear has been documented in the social media accounts of healthcare workers (HCW), often in relation to the concept of “exhaustion” and suggested that the discomfort of PPE might impact adherence (Arasli et al., 2020). PPE discomfort is a source of stress for nurses (Kuo et al., 2020), and at least three other studies confirm that adherence is impacted by the physical discomfort of PPE (Ciris Yildiz et al., 2020; Daugherty et al.,2009; Houghton et al., 2020). However, one qualitative study of Australian nurses following the H1N1 influenza pandemic suggested that the physical discomfort of PPE may be overlooked by providers as a trade-off for what is perceived as adequate protection against the infectious agent (Corley, Hammond & Fraser, 2009)

Twenty-six studies were identified that described the physical effects of PPE. Side effects described in the literature include headache (Farronato et al., 2020; Gupta, Singh & Gupta, 2020; Lim et al., 2006; Ong et al., 2020; Tabah et al., 2020), adverse skin reactions (Foo et al., 2006; Gupta, Singh & Gupta, 2020; Hu et al., 2020; Lin et al., 2020; Pei et al., 2020), difficulty breathing (Houghton et al., 2020; Perna et al., 2020), rhinitis and nasal symptoms (Klimek et al., 2020; Purushothaman et al., 2020), eye discomfort (Giannaccare et al., 2020; Gupta, Singh & Gupta, 2020), ear discomfort and dermatitis (Bothra et al., 2020; Gupta, Singh & Gupta, 2020), sweating and thermal stress (Houghton et al., 2020; Gupta, Singh & Gupta, 2020; Lee et al., 2020; Parush et al., 2020) and a reduction in visual field (Lawrence et al., 2020; Parush et al., 2020). As described previously, “PPE” was not clearly defined in each study. Overall, the more severe physical effects (such as headaches, breathing problems, impaired cognition) were seen from N95 masks, while more minor effects (such as ear discomfort and skin reactions) were seen from procedural masks.

Headaches were consistently described as a side effect of wearing N95 masks (also known as FFP2 masks) (Farronato et al., 2020; Gupta, Sing & Gupta, 2020; Lim et al., 2006; Ong et al., 2020; Tabah et al., 2020). More

specifically, wearing an N95 mask and protective eyewear together was associated with 1.5X odds of developing headache (Ong et al., 2020). Headaches are hypothesized to be due to pressure from the mask straps, associated hypercapnia, hypoxemia, and stress (Farronato et al., 2020). These factors also impact working ability, concentration, and productivity (Farronato et al., 2020; Lee et al., 2020; Parush et al., 2020). These same factors (hypercapnia, hypoxia, and changes in breathing patterns) may also trigger panic symptoms in those who are prone to them (Perna et al., 2020).

Adverse skin reactions, such as dryness, redness, rash, or blisters, were very commonly described in the literature (Foo et al., 2006; Gupta, Singh & Gupta, 2020; Hu et al., 2020; Lin et al., 2020; Pei et al., 2020). Both headache and skin injury were both significantly associated with enhanced levels of PPE and wear time greater than 4 hours (Ong et al., 2020; Jiang et al., 2020; Lin et al., 2020; Pei et al., 2020).

Of note, a few studies were identified that examined the experiences of healthcare workers with the powered air-purifying respirator (PAPR). In general, it was found to be uncomfortable, inconvenient and inhibited communication (Kang et al., 2018; Khoo et al., 2005), however, the PAPR systems are not expected to be deployed in Alberta for general use.

A new systematic review by Jefferson et al. (2020) examined the effectiveness of physical interventions to interrupt or reduce the spread of respiratory viruses. As suggested by Chou et al. (2020) and confirmed by Jefferson (2020), adverse events were poorly reported in the controlled trial literature. However, the risks and harms of PPE identified in Jefferson (2020) confirm the findings of the observational and qualitative literature included in the present review. The findings of Jefferson et al. (2020) regarding adverse events are summarized in table X below. It is important to note that while the discomfort and adverse effects of PPE is irritating to wearers, the harms are not generally permanent. Except for skin rashes, the physical side effects of PPE (such as headache) have been shown to resolve shortly after removal (Ong et al. 2020).

Table X. Adverse events from PPE described in the randomized controlled trial literature included in Jefferson et al. (2020).

Intervention	Number of studies	Reported adverse events	Certainty of the evidence (GRADE)
Medical/surgical masks	3 RCTs	Main issues for adults and children were: - Warmth/humidity - Pain - Respiratory difficulties - General discomfort	Very low
N95 respirators	5 RCTs	Four RCTs either reported no adverse events or only reported on comfort wearing masks. One study explicitly described the side effects of masks and found that adverse events were more common with N95 masks than with medical/surgical masks. - Discomfort was reported in 41.9% of N95 wearers versus 9.8% of medical mask wearers ($P < 0.001$) - Headaches were more common with N95 (13.4% versus 3.9%; $P < 0.001$) - Difficulty breathing was reported more often in the N95 group (19.4% versus 12.5%; $P = 0.01$) - N95 caused more problems with pressure on the nose (52.2% versus 11.0%; $P < 0.001$).	Very low

Intervention	Number of studies	Reported adverse events	Certainty of the evidence (GRADE)
Cloth masks	2 RCTs	Cloth masks do not have significantly different or significantly more or less adverse effects than medical/surgical masks; however, they offer little protection against respiratory infection	n/a

Effects of PPE on communication and the therapeutic relationship
Twelve studies were identified that described the effect of PPE on communication between healthcare providers and the subsequent effect on the therapeutic relationship.

PPE was shown to impair speech quality and volume (Gupta, Singh & Gupta, 2020), comprehension (Parush et al., 2020), speech recognition and discrimination (Bandaru et al., 2020), speech processing in environments with significant background noise (such as operating theatre settings) (Hampton et al., 2020) and reduced speech intelligibility (Ribeiro et al., 2020). These challenges are noted to degrade communication between care providers (Lawrence et al., 2020). Increased vocal effort and the increased cognitive load of understanding speech was reported to affect fatigue, situational awareness, and decision-making (Parush et al., 2020; Ribeiro et al., 2020). These difficulties were seen with level 1 PPE (full PPE) (Parush et al., 2020), as well as with N95 masks, surgical masks, and cloth masks (Ribeiro et al., 2020).

Masks also affect the ability of care providers to fully relate to their patients. In an experimental (non-clinical) study, Carbon (2020) reports that masks significantly affect an individual's ability to recognize and differentiate between emotions. This finding was validated by care providers in qualitative studies of clinical PPE, as providers note that masks limit non-verbal communication and create a barrier that impacts the therapeutic relationship (Hines et al., 2020; Galehdar et al., 2020; Houghton et al., 2020; Tan et al., 2006; Palinkas et al., 2020). In adults, this barrier is not perceived to affect the quality of care (Palinkas et al., 2020); however, pediatric care providers report that masks cause fear in children, which impacts the providers ability to engage and provide care for the child (Shack et al., 2020).

Impacts of PPE and isolation precautions on care quality
Thirteen studies were identified that describe the impact of PPE and isolation precautions on the quality of care provided to patients. In general, the evidence is inconsistent. Three systematic reviews suggest that isolation precautions for adults in acute care do not impact care quality by multiple metrics (Abad, Fearday & Safdar, 2010; Berry et al., 2020; Purssell, Gould & Chudleigh, 2020). However, each notes that the body of evidence is heterogeneous and Berry (2020) specifically notes that they have very low – low certainty in their conclusions. This effect, or lack thereof, is also seen in individual studies of pediatric inpatient care and of long-term care (Cohen et al., 2008; Pineles et al., 2018). Pineles (2018) showed that residents in long-term care who were under isolation precautions actually received more visits per hour and care activities than their non-isolated counterparts.

The only outcome that is consistently shown to be associated with isolation precautions is delirium. Delirium is significantly more prevalent in isolated patients than in non-isolated patients, and patients placed on contact precautions are have 1.4 X higher odds of experiencing delirium (Day et al., 2012; Purssell, Gould & Chudleigh, 2020). One study also found that processes of care related to pneumonia, such as pneumococcal vaccine, influenza vaccine, and smoking cessation, were more likely to be missed in isolated patients (Morgan et al., 2011). These shortcomings were not observed in care for isolated patients with congestive heart failure or acute myocardial infarction (Morgan et al., 2011).

Conversely to observational studies, surveys of healthcare providers who care for patients on isolation precautions suggested that patients under isolation are less likely to be examined and may not efficiently have their needs met (Khan, Khakoo & Hobbs, 2006). Further, the delegation of duties by attending physicians to

medical residents may result in less experienced care provided to patients on isolation precautions compared to non-isolated patients (Saint et al., 2003)

As described in the limitations above, it is difficult to separate the effect of PPE from other administrative and care processes on the quality of care provided to patients on isolation precautions. Specific studies of PPE on care have mixed results – full PPE has no impact on endoscopy quality (Teh et al., 2020), while surgeons feel that full PPE causes communication issues, visual interference, and reduced situational awareness (Yánez Benítez et al., 2020). Indeed, some aspects of PPE may even be beneficial to care. Universal gloving practices worn during RSV season have been shown to significantly reduce hospital-associated bloodstream infections and central-line associated infections (Yin et al., 2013).

Taken together, these findings suggest that care quality is specific to the individual hospital, patient, and care context.

Patient experience and perceptions of PPE and isolation precautions
Seven studies were identified that describe patient perceptions and experiences with isolation precautions.

The evidence regarding the psychological effect of isolation of patients is mixed. Three studies (one a systematic review) report that isolation precautions have a negative impact on patient psychology and behavior, such as increased scores for depression and anxiety, anger-hostility, fear, and loneliness (Abad, Fearday & Safdar, 2010; Jesus, Dias & Figueiredo, 2019; Catalano et al., 2003). Conversely, three studies (one a systematic review) found no significant difference between isolated and non-isolated patients with respect to length of stay, depression, anxiety, health-related quality of life, 30-day readmission, or death (Lau, Majumdar& McAlister, 2016; Purssell, Gould & Chudleigh, 2020); Wassenberg, Severs & Bonten, 2010).

Two studies showed that isolation precautions do not appear to impact the patient perspective on care. Isolated patients have not been shown to have a negative perception of their care and understand that isolation is for their own benefit and the safety of others (Gasink et al., 2008). Indeed, individual rooms may provide more comfort and privacy, and offer a sense of protection (Jesus, Dias & Figueiredo, 2019). As with the impacts of isolation on care quality, the patient perception of isolation precautions appears to be context-specific and the findings may not be relevant to a pandemic setting.

Effects of PPE on healthcare provider behaviours
Seven studies were identified that describes the effects of mandates for full PPE / continuous PPE on the behaviour of healthcare providers.

The availability of PPE plays a key role in staff behaviour. Fears of PPE shortages can be triggered by both increasing the requirements (staff may perceive that they will run out of PPE too quickly) or by decreasing the requirements (staff may perceive that reduced requirements are part of a conservation strategy and worry that they are not protected) (Corley, Hammond & Fraser, 2009). These fears may be mitigated by clear communication about guidelines and rationale for changing the guidelines (Corley, Hammond & Fraser, 2009).

Only one study noted that PPE may lead to a false sense of security in healthcare providers (Gupta, Singh & Gupta, 2020). Fears of complacency appear to be unfounded – Houghton (2020) suggests that adherence is influenced by social norms and culture – when everyone is wearing PPE, there is improved attention to guidelines and good PPE practice. However, adherence is complicated. Qualitative surveys suggest that adherence will decrease if PPE is believed to be inconvenient to normal routines and processes or if the PPE hinders the ability to perform care (Hines et al., 2020; Tan et al., 2006; Daugherty et al., 2009).

There is a risk that staff will not take care of their own needs if the PPE requirements are considered burdensome. It was noted in five studies that the inconvenience of donning and doffing PPE prevents staff from fully utilizing breaks, eating, drinking, and using the toilet (Galehdar et al., 2020; Houghton et al., 2020; Lee et al., 2020; Tabah et al., 2020; Tan et al., 2006). These restrictions, combined with the physical discomfort of PPE and impaired communication affects the mood of care providers and over time could erode staff morale (Galehdar et al., 2020).

Research Question 5: Which care areas (e.g., ICU, emergency, perioperative care) pose the highest risk of COVID-19 for healthcare workers?

A total of 22 articles (16 peer-reviewed; 2 peer-reviewed and pre-proof) were included in the narrative synthesis. Eighteen articles were included from abstract and full-text screening of citations identified from electronic database searching. An additional 4 articles were identified from hand-searching the references lists of relevant systematic and rapid reviews. All of the included articles were of observational studies: 12 cross-sectional studies (1 pre-print); 5 prospective cohort studies (2 were pre-print), 2 retrospective observational studies, 2 case control studies; and 1 study was described as an observational cohort study (pre-print) that included a prospective cohort design and a cross-sectional survey.

Evidence from the primary literature

The characteristics of the included studies and main findings are provided in Table 4. Most of the studies were conducted in the United Kingdom (n=5) or Europe (Spain n=3; Italy n=3; France n=1; Denmark n=1; Sweden n=1; Belgium n=1; Turkey n=1). The remaining studies were conducted in China (specifically the city of Wuhan, n=2) and 2 in the United States (New York state n=1, national n=1). Ten studies were conducted in a single acute healthcare facility, 9 studies were multi-centre (acute care, community, and primary care facilities), and 3 were national-level (included multiple healthcare facilities within a country).

The participants in all of the studies were healthcare workers (HCWs) and were categorized into clinical specialties or areas of care where they primarily worked during the study period. The specific areas of care varied widely across included studies (Table 4). For all but one study (Wei et al., 2020), the study outcome of interest was the association between areas of care and COVID-19 infection among HCWs, confirmed through either microbiological PCR tests for SARS-CoV-2 or Anti-SARS-CoV-2 IgG assay from sera (seropositivity). The outcome of interest for the remaining study was the association between the clinical setting and developing severe or critical symptoms of COVID-19 among HCWs (Wei et al., 2020). Any covariates included in adjusted analyses, when reported, are noted in Table 4 (see ‘Methodological Notes’ column). Demographic characteristics of HCWs (e.g., age and sex) were commonly included covariates in adjusted analyses, whereas adjustments for COVID-19 community activity in HCWs’ areas of residence were not explicitly reported by any study. Given the observational nature of the included studies, the study quality ranged from low to moderate and studies were broadly limited by sampling bias, short study or observation periods, recall bias (for participant self-reported data), measurement bias, and reporting bias (incomplete data and methods reporting). These limitations, in addition to those elaborated below, should be considered when interpreting the findings.

Table 4. Summary of Included Studies Examining the Association between Care Setting and COVID-19 Among Healthcare Workers

<table>
<tr><th>Author
Date
Country</th><th>Study Design &
Time period</th><th>Healthcare
Setting</th><th>Areas of Care
Examined &
No. of Participants</th><th>Key Findings[1]</th><th>Methodological Notes[1]</th></tr>
<tr><td>Algado-Selles (2020)

Spain</td><td>Prospective cohort

7 weeks (March 2, 2020 - April 19, 2020)</td><td>Tertiary hospital and 12 primary healthcare centres</td><td>Emergency service (n=37)

Pediatric areas (pediatric emergency service, surgical pediatric wards, medical pediatric wards and pediatric ICU. (n=48)

Critical care units (medical ICU, surgical ICU, and operating theatre) (n=120)

Adult medical wards (n=281)

Primary health care (n=97)

Non-COVID-19 wards (adults surgical wards; administrative areas; central services: laboratory, microbiology, pharmacy, radiology, blood bank, etc.)</td><td>• Clinical service in which the HCW performed their activity was not significantly associated with being diagnosed with COVID-19
• Adjusted Odds Ratio (aOR) for COVID-19 diagnosis by clinical service:
<table><tr><th>Clinical Service</th><th>aOR (95% CI)</th><th>p-value</th></tr><tr><td>Emergency service</td><td>0.7 (0.2, 1.9)</td><td>p=0.442</td></tr><tr><td>Pediatric areas</td><td>0.4 (0.1, 2.2)</td><td>p=0.112</td></tr><tr><td>Critical care units</td><td>0.8 (0.3, 1.7)</td><td>p=0.296</td></tr><tr><td>Adult medical wards</td><td>0.7 (0.4, 1.4)</td><td>p=0.370</td></tr><tr><td>Primary health care</td><td>1.1 (0.5, 2.2)</td><td>p=0.888</td></tr><tr><td>Non-COVID-19 wards</td><td>Reference group</td><td>--</td></tr></table></td><td>aORs and 95% CIs were calculated using a logistic regression model based on the variables that showed an association in the bivariate analysis, including professional category, reason for contact, type of contact, contact characteristics, and department.</td></tr>
</table>

[1] Text primarily extracted verbatim from reference

			(n=201)		
Baxendale Pre-print: November 13, 2020 United Kingdom	Prospective cohort 2 months (April 20, 2020-June, 10 2020)	Hospital specializing in cardiothoracic medicine and critical care	Critical care patient-facing (n=126) Non-critical care patient-facing (n=284) Non-patient facing (n=63) Not applicable (n=27)	• Staff working with critical care patients **were significantly less likely** to be positive for COVID-19 than staff in non-patient facing roles (β=-1.06, SE=0.44, Z=-2.39, p=0.017) • Seropositivity for COVID-19 for non-critical care patient facing staff was not significantly different compared to non-patient facing staff (β=-0.49, SE=0.36, Z=-1.14, p=0.172) at 15 and 22% seropositive, respectively.	Binomial logistic regression was used to estimate infection risk using area of work as a predictor variable. The significance of the two patient facing areas was assessed by Wald Z-tests in contrast to the non-patient facing staff.
Bistoquet Pre-proof: October 8, 2020 France	Cross-sectional April 21, 2020 - June 3, 2020	One hospital	Highly exposed (medical, intensive care and screening COVID-19 units) (n=261) Mildly exposed (non-COVID-19 units) (n=227) Unexposed (administration or laboratories) (n=159)	• **Increased odds** of being positive for SARS-CoV-2 **in the highly exposed group** (aOR = 4.43 (95% CI 1.15-17.06) relative to those in the mildly and unexposed groups (p = 0.031)	*No methods were reported in the manuscript*
Celebi (2020) Turkey	Case control 60-day period (March 20-May 20, 2020)	Teaching and tertiary care hospital	COVID-19 Unit (n=527) Non-COVID-19 Unit (n=176)	• **Increased relative risk (RR) of RT-positivity rates among HCWs in COVID-19 units** (RR = 2.449 (95% CI = 1.062-5.649) relative to HCWs in non-COVID-19 units (p = 0.027)	Binary logistic regression analysis was performed using stepwise backward selection to identify independent predictors associated with SARS-CoV-2 positivity in HCWs. All variables with a P-value <.20 in the initial analysis were included in the multivariate analysis.
Chatterjee (2020) India	Case control May 8-23, 2020	All healthcare facilities in India captured in national data portal of COVID-tested individuals	ICU with suspected or confirmed COVID-19 cases on ventilator (n=93) Other (n=658)	• **No difference** in vulnerability to SARS-CoV-2 infection among HCWs placed in ICUs with suspected or confirmed COVID-19 (OR = 1.36 (95% CI: 0.88-2.1)) compared to HCWs that were not (p=0.17)	Logistic regression model adjusted for gender, use of PPE, endotracheal intubation, different intensity of exposure to prophylactic HCQ and testing place with date.

<table>
<tr><td></td><td></td><td></td><td></td><td></td><td>These variables had biologically plausible association with the outcome and were relevant for planning strategies for the prevention of SARS-CoV-2 infection in HCWs.</td></tr>
<tr><td>Colaneri (2020)

Italy</td><td>Retrospective cohort

February 22, 2020 –
May 8, 2020</td><td>Hospital appointed as COVID-19 referral center</td><td>COVID-19 ward (n=465)

Non-COVID-19 clinical ward

No contact with patients (n=157)</td><td>• Working in a COVID ward was significantly associated with an increased rate of SARS-CoV-2 infection (compared with working in other clinical wards)
• Multivariable Poisson regression for estimating the relative incidence rates of COVID-19 among screened HCWs:<table><tr><th>Clinical Service</th><th>aIRR (95% CI)</th><th>p-value</th></tr><tr><td>Without contact with patients</td><td>0.67 (0.30-1.48)</td><td>p=0.322</td></tr><tr><td>COVID ward</td><td>2.81 (1.95-4.03)</td><td>p=0.0001</td></tr><tr><td>Other clinical ward</td><td>Reference group</td><td></td></tr></table></td><td>Poisson regression to calculate specific COVID-19 incidence rate ratios (IRRs) and 95% confidence intervals considering potential risk factors of COVID-19 infection.

Predictors included in the statistical model were age, length of service in the hospital, sex, job role, working environment, body mass index (BMI), hypertension, smoking habit and alcohol consumption.</td></tr>
<tr><td>Cooper

Pre-print: November 4, 2020

United Kingdom</td><td>Prospective cohort

June 10, 2020 – August 7, 2020</td><td>Tertiary referral centre and teaching hospital</td><td>Clinical settings divided into 5 divisions[2]

Division A (n=808)
Division B (n=1211)
Division C (n=417)
Division D (n=616)
Division E (n=741)</td><td>• Staff working in Division C (including acute medicine, medical sub-specialities and emergency department) had higher adjusted odds of having detectable SARS-CoV-2 antibodies compared to those in Division E (paediatrics, gynaecology, obstetrics)
• aOR for COVID-19 diagnosis by Division:</td><td>Logistic regression was used for univariable and multivariable analyses of seroprevalence comparisons.

The aOR controlled for age, sex, ethnicity, job role and COVID-19 area working.</td></tr>
</table>

[2] Division A: Critical care, Anaesthetics, General surgery, Gastrointestinal surgery, Rheumatology, Gastrointestinal medicine, Theatres, Trauma and Orthopaedics

Division B: Blood Sciences, Oncology, Histopathology, Haematology, Pharmacy, Outpatients, Radiology, Urology, Therapies,

Division C: Acute medicine, Elderly care, Emergency Department, Hepatobiliary surgery, Nephrology, Infectious diseases, Respiratory, Transplant

Division D: Cardiology, Endocrine, Dermatology, ENT, Opthalmology, Neurosciences, Plastics, Rehab, Stroke, Vascular surgery

Division E: Paediatrics, Gynaecology, Midwifery, Obstetrics

				Division / **aOR (95% CI)** / **p-value** A: 1.16 (0.74-1.80); 0.52 B: 1.08 (0.71-1.66); 0.71 **C: 2.07 (1.31-3.25); 0.002** D: 1.26 (0.80-1.99); 0.33 E: Reference group; --	

Eyre (2020)
 	
United Kingdom
	Prospective cohort
	
	Mid-March 2020 – June 8, 2020
		Four teaching hospitals	Anaesthetics (n-244)
			
			Emergency Medicine (n=344)
			General Surgery, Urology, Plastics, Vascular, Cardiothoracic Surgery (n=519)
			
			Haematology, Oncology (n=333)
			
			Infectious Diseases, Respiratory (n=209)
			
			Intensive Care Medicine (n=448)
			
			Medicine (n=793)
			
			Obstetrics and Gynaecology (n-250)
			
			Ophthalmology, Ear, nose and throat surgery, Maxillofacial surgery (n=171)
			
			Paediatrics (n=588)
				• **Risk of infection varied by specialty**
				• Compared to those working in an other or no clinical specialty**, increased risk of COVID-19 infection** was identified among those working in:
				  • **Acute medicine** (aOR 1.52, 95% CI 1.07–2.16, p=0.02)
				  • **Orthopaedics, trauma, rheumatology** (aOR 1.86, 95% CI 1.26-2.74), p=0.002)
				  • **Haematology, oncology** (aOR 1.88, 95% CI 1.27-2.78, p=0.002)
				• Those **in ICUs were at lower risk of infection** (0.44, 0.28–0.69, p<0.001)
					Univariable and multivariable logistic regression was performed to assess risk factors for infection using a composite endpoint of 'Covid-19 at any time', based on a positive RT-PCR test or the detection of IgG by ELISA and/or CMIA.
					
					Given the number of potential predictors fitted, backwards model selection was undertaken using AIC values. We screened for first-order interactions between main effects using a Wald p-value threshold of <0.01.

			Radiology (n379) Specialist Medicine (n=1087) Trauma and Orthopaedics, Rheumatology (n=323) Other or none (n=4346)		
Firew (2020) United States	Cross-sectional 7-day period in May 2020	A convenience sample of US HCWs who worked on the front lines during the COVID-19 pandemic in 48 states, the District of Columbia and US territories (Puerto Rico, US Virgin Islands) during May 2020	Emergency department (ED) (n=651) ICU (n=328) Inpatient hospital (n=427) Pre-hospital (n=176) Outpatient (n=224) Long-term care facility/nursing home (n=74) Other (n=160)	• Relative to HCWs working in the ED during COVID-19, HCWs **in the Intensive Care Unit** (PR=0.73, 95% CI 0.58 to 0.92) and **inpatient hospital settings** (PR=0.81, 95% CI 0.66 to 0.98) displayed **a lower probability of infection** • **No differences** in the probability of infection between those **working in ED** compared with prehospital, outpatient or long-term care/nursing home facilities.	We constructed log-binomial models to calculate the prevalence ratio (PR) describing the relative probability of infection by demographic characteristics (age, gender, race/ethnicity, US region), clinical workplace characteristics (position, specialty, regular clinical setting, clinical setting during COVID-19 crisis), exposure to COVID-19 patients and access to PPE

Galan
 	
Pre-print: May 29, 2020
 	
Spain
	Cross-sectional
	
	April 14-27, 2020
		General public hospital that covers a population of 170,000 inhabitants	Critical care unit (n=226)
			Hospitalized COVID-area (n=887)
			
			Hospitalized non-COVID area
			
			Central units (n=298)
			
			Emergency room (n=253)
				• **Significantly increased probability** of SARS-CoV-2 IgG positive among HCWs in:
				  • **COVID-19 hospitalization areas** (OR 1.71, CI95% 1.22-2.40)
				  • **Non-COVID-19 hospitalization areas** (OR 1.88, CI95% 1.30-2.73)
				  • **Emergency room** (OR 1.51, CI95% 1.01-2.27)
					A univariate analysis was carried out to find independently associated risk factors for positive IgG. A multivariate logistic regression model evaluated the association between risk factors and positive IgG was assessed by reference to odds ratio (OR).
					
					The independent variables included in the model were age, sex, cardiovascular disease,

			Management (n=226) – reference case		professional category (model 1) and work area (model 2)
Garcia-Basteiro (2020) Spain	Cross-sectional (first of a series of 4 cross-sectional surveys) March 28 – April 9th, 2020	Large, public teaching hospital	Working in a COVID-19 unit (n=263) Not working in a COVID-19 unit (n=315)	• **Working in a COVID-19 unit was not associated with seropositivity** (OR: 0.88, 95% CI: 0.50, 1.55, p-value=0.65)	Univariable logistic regression model to evaluate individual factors associated with seroprevalence of antibodies against SARS-CoV-2.
Iversen (2020) Denmark	Observational cohort (Prospective cohort & cross-sectional survey) April 15 – April 23, 2020	All somatic, psychiatric, prehospital staff, and staff at specialized healthcare institutions employed in the Capital Region of Denmark	Working on decidcated COVID-19 wards (n=1321) Other frontline in-hospital healthcare workers (n=15,983)	• **Significantly increased** seroprevalence in participants **working at a dedicated COVID-19 ward** (RR 1·65 [95% CI 1·34–2·03]; p<0·001) compared with other frontline in-hospital health-care workers	Possible associations between exposures and the primary outcome were explored by risk ratios (RRs). RRs were calculated as the probability of the outcome in the exposed group compared with that in the unexposed group. RRs were presented with 95% CIs, calculated using the normal approximation (Wald) and the significance (Fisher's exact test) as implemented in the R package epitools.
Lai (2020) China	Retrospective case-series January 1 to February 9, 2020	One hospital	Fever clinic or ward (n=3110) Other clinical department (n=4506) Department with no patient contact (n=2032	• Working in **other clinical departments** than fever clinics or wards was associated with **increased risk of infection** (IRR 3.1; 95%CI, 1.8-5.2, P < .001)	The Poisson regression model was used to calculate the incident rate ratio (IRR) and 95% CIs for HCWs with COVID-19.
Lidstrom (2020) Sweden	Cross-sectional May 27, 2020 – June 25, 2020	Healthcare settings in one region, including a university hospital, primary health care settings, and	COVID-19 possible unit (n=426) Working in COVID-19 specific unit (n=1793)	• **No difference** in the odds of SARS-CoV-2 infection between those **working in a COVID-19 specific units and not** (OR: 1.114, 95% CI: 0.766-1.619) • **No difference** between **those** working **in COVID-19 possible units and not** (OR: 1.275, 95% CI: 0.945-1.721, p=0.112)	Multivariable logistic regression model, using age, gender, and sampling time as covariates

		community hospital			
Martin (2020) United Kingdom	Cross-sectional May 29-July 13, 2020	All university hospitals in one National Health Service trust	ED & Acute medicine (n=831) Medicine other than acute (n=1498) Surgery (n=1718) Paediatrics (n=519) Haematology & oncology (n=327) Radiology & imaging (n=512) Obstetrics & gynaecology/maternity (n=652) Anaesthetics & ICU (n=524) Laboratory-based (n=677) Pharmacy (n=251) Community/ Outpatients (n=277) Other clinical services (n=566)	• **Compared to those working in ED/Acute medicine** (reference group), those working in specialties were **significantly less likely to** have detectable anti-SARS-CoV-2 IgG, including • **Paediatrics** (aOR: 0.38, 95% CI 0.25, 0.57, p<0.001) • **Anaesthetics/ICU** (aOR: 0.41, 95% CI: 0.27, 0.61, p<0.001) • **Radiology & imaging** (aOR: 0.41, 95% CI: 0.24, 0.70, p=0.001) • **Obstetrics & gynaecology/maternity** (aOR: 0.57, 95% CI: 0.40, 0.82, p=0.002) • **Laboratory** (aOR: 0.53, 95% CI: 0.34, 0.81, p=0.003) • **Pharmacy** (aOR: 0.39, 95% CI: 0.18, 0.86, p=0.02)	Logistic regression to (i) evaluate factors associated with seropositivity (ii) estimate the odds ratio of antibody positivity. aOR adjusted for age, sex, ethnicity, occupation, specialty, Index of Multiple Deprivation quintile, population density and reason for absence from work.
Mortgat Pre-print: October 6, 2020 Belgium	Cross-sectional (baseline analysis of ongoing prospective cohort study)	Hospitals in Belgium	COVID-19 ICU unit (n=102) COVID-19 non ICU unit (n=268)	• **Working in a COVID-19 unit (ICU or non-ICU) was not identified as a risk factor for seropositivity** (PR: 0.85, 95% CI: 0.35-2.09)	Poisson regression adjusted for the sampling probability to identify association between anti-SARS-CoV-2 IgG seropositivity and health and work related risk factors as well as symptoms.

<table>
<tr><td></td><td>April 22 – April 26, 2020</td><td></td><td></td><td></td><td>Associations from univariate models and weighted prevalence ratios (PR) were reported.</td></tr>
<tr><td>Moscola (2020)

United States</td><td>Cross-sectional

April 20, 2020 – June 23, 2020</td><td>Largest health system in New York state</td><td>Emergency department (n=3089)

Intensive care unit (n=3355)

Hospital units (non-ICUs) (n=9976)

Other (n=20,303)</td><td>• Primary location of work was not associated with risk of testing positive for SARS-CoV-2 antibodies
• RR for COVID-19 diagnosis by primary location of work:<table><tr><th>Location</th><th>OR (95% CI)</th></tr><tr><td>Emergency department</td><td>Reference group</td></tr><tr><td>ICU</td><td>0.98 (0.93-1.02)</td></tr><tr><td>Hospital units</td><td>1.00 (0.96-1.04)</td></tr><tr><td>Other</td><td>0.99 (0.95-1.03)</td></tr></table></td><td>Associations among seroprevalence and these variables was assessed using multivariable Poisson logistic regression.

Covariates included demographics, primary work location, job function, direct patient care, work on a COVID or non-COVID unit, and HCWs level of suspicion of virus exposure</td></tr>
<tr><td>Olanyanju

Pre-proof: November 11, 2020

South Africa</td><td>Cross-sectional</td><td>Tertiary university hospital</td><td>Surgery (n=13)

Medicine (n=17)

Emergency (n=42)

Obstetrics and gynecology (O&G) (n=10)

Chemical pathology (n=22)

Hematology (n=8)

Microbiology (n=6)</td><td>• The participants from emergency (OR = 3.151; 95% CI = 1.061-9.357; P = 0.039) and O&G (OR = 19.286; 95% CI = 2.028-183.412; P =0.010) showed significantly higher odds of seropositivity compared to those in chemical pathology (reference group)</td><td>Univariate logistic regression was used to determine the relationship between demographic and clinical variable and seropositivity to the SARS-CoV-2 IgG</td></tr>
<tr><td>Piapan (2020)

Italy</td><td>Cross-sectional

March 1 – April 6, 2020</td><td>Hospitals in north-eastern province Italy</td><td>HIGH RISK: Geriatric and infectious disease (n=65)

MEDIUM RISK: Internal medicine (n=112)

LOW RISK:</td><td>• The vast majority of HCWs infected with COVID-19 were employed in medical wards, with a significantly higher odds (compared to low risk group) in:
• Geriatric and Infectious Diseases (OR: 67.9, 95% CI: 34.7-133)
• Internal Medicine (OR 9.6, 95% CI 5.6-16.5)</td><td>No methods were reported in the manuscript</td></tr>
</table>

			First aid, dialysis unit, surgical wards, other medical departments, radiology, rehabilitation, others (n=726)		

Porru (2020)
 	
Italy
	Prospective cohort
	
	February 28 – April 28, 2020
		Large public university hospital	Medical ward (n=2014)
			
			Surgical ward (n=1468)
			
			Health services (including all hospital outpatient services (e.g., emergency rooms, diagnostic services, occupational medicine, forensic medicine, technical services) (n=1948)
			
			*Also examined working in COVID-19 unit:
			Yes (n=1134)
			No (n=4808)
				• Compared to hospital administration, the **risk of infection was observed to be high in:**
				  • **Medical wards (**OR: 2.74, 95% CI: 1.93-3.91)
				  • **Health services** (OR 4.31, 95% CI 2.44-7.62)
				• **No association between working in a COVID-19 unit and infection** (OR: 0.99, 95%CI: 0.70-1.40)
					Multivariable analysis was accomplished using a logistic regression model, where SARS-CoV-2 detection was the response variable, and sex, age, work setting, and occupation were the potential determinants

Shields (2020) United Kingdom	Cross-sectional April 24-25, 2020	All university hospitals in one National Health Service trust	Acute medicine (n=30) Emergency department[3] General internal medicine (n=15) General surgery (n=23) Intensive care[3] Obstetrics and gynaecology[3]	• Working in **intensive care medicine was associated with significantly reduced risk of seropositivity (**adjusted OR: 0.28, 95% CI 0.09 to 0.78, p=0.02) in multivariate analysis	Multivariate logistic regression analyses were undertaken using serostatus as the dependent variable and incorporating participant age, sex, ethnicity, Index of Multiple Deprivation score of participants' postcodes and the hospital departments where participants worked as independent variables.

[3] n within this sub-group not reported

Wei (2020) China	Cross-sectional February 27, 220	5 general hospitals	Infection department (n=186) General department (n=56) Opthalmology department (n=43) Respiratory department (n=13)	• Compared to those in the infection department (reference group), HCWs **more likely to develop severe and critical symptoms worked in:** • **General department (**OR = 2.86, 95% CI 1.20–6.66) • **Ophthalmology department** (OR = 4.45, 95% CI 1.88–10.44) • **Respiratory department** (OR = 13.35, 95% CI 3.93–47.23)	Backward stepwise multivariate logistic regression was utilized to identify high-risk departments where HCW cases worked to develop severe or critical symptoms. Age, sex, days from onset to diagnosis and department were included in the multivariate logistic regression.

Areas of care associated with increased risk of COVID-19 infection among HCWs

Broadly, the findings across studies are mixed, with 10 studies reporting positive associations between specific clinical area of work and COVID-19 infection among HCWs.

Four studies reported that HCWs working in "COVID-19 units or wards" (i.e., clinical areas designated for COVID-19 positive patients) were at increased risk of COVID-19 infection compared to those working in "non-COVID-19 units or wards" (Bistoquet et al., 2020; Celebi et al., 2020; Colaneri et al., 2020; Iversen et al., 2020). Celebi et al. (2020) and Iversen et al. (2020) reported relative risks of COVID-19 infection among HCWs in COVID-19 units ranging from 1.65 (95% CI: 1.34–2.03) to 2.449 (95% CI: 1.062-5.649), respectively, compared to HCWs working in non-COVID-19 units. The latter study had a relative large sample size (n=17,304) including participants across the study country (Iversen et al., 2020). Similarly, the cross-sectional study conducted by Bistoquet et al. (2020) reported increased adjusted odds of HCWs COVID-19 infection (OR: 4.43, 95% CI: 1.15-17.06) for those working in medical, intensive care and screening COVID-19 units compared to non-COVID-19 wards. These findings, however, must be interpreted with caution as no methodological details were available in the pre-proof version of the article (Bistoquet et al., 2020). Colaneri et al. (2020) conducted a single-centre retrospective cohort study and reported that working in a COVID-19 ward was associated with an increased rate of COVID-19 infection (incident rate ratio [IRR]: 2.81, 95% CI: 1.95-4.03) compared to other clinical wards. One additional study by Galan et al., (2020) reported increased odds of COVID-19 infection among HCWs working in COVID-19 hospitalization areas (OR: 1.71, 95% CI: 1.22-2.40) relative to staff in non-patient facing areas; these odds were similar, however, to HCWs in non-COVID-19 hospitalization areas (OR: 1.88, 95% CI: 1.30-2.73).

None of the aforementioned studies described the types of PPE used among participants, nor how they may differ between the care areas examined. Celebi et al. (2020) found that inappropriate use of PPE while caring for a suspected or confirmed COVID-19 patient to be a prominent risk factor for COVID-19 infection among HCWs (OR: 11.295, 95% CI: 2.183-59.429), but did not report subgroup analyses to determine whether or how this may differentially apply between HCWs in COVID-19 units and non-COVID-19 units. Bistoquet et al. (2020) reported a relatively low overall COVID-19 seroprevalence among its study sample (<5% testing positive [n=12]) and the authors attributed 1 HCW infection in the COVID-19 ward to inconsistent masking around colleagues. While availability of PPE, in terms of shortages, was not described among included studies, Colaneri et al. (2020) commented that a continuous supply of respirators, surgical masks, liquid-repellent gowns, hair caps, overshoes, and goggles or face shields were available to all HCWs in the hospital throughout the study period.

Conversely, 4 studies (Garcia-Basteiro et al., 2020; Lidstrom et al., 2020; Mortgat et al., 2020; Porru et al., 2020) reported that working in a COVID-19 unit was not associated with COVID-19 infection, with ORs ranging from 0.88 (95% CI: 0.50-1.55) to 1.275 (95% CI: 0.945-1.721). Three of the studies were designed as cross-sectional studies—two of which had a relative large (n>1000) or nationally-representative sample—and 1 was a single-centre prospective cohort study. Lai et al., (2020) also found that in their retrospective case series in one hospital, HCWs working in clinical departments other than those designated for patients with fever (referred to as "fever clinics or wards") was associated with an increased risk of COVID-19 infection (IRR: 3.1, 95%CI: 1.8-5.2) (Lai et al., 2020). Garcia-Basteiro et al., (2020) hypothesized that the lack of association may be attributed to a higher perception of infection risk among HCWs in COVID-19 designed units, thus leading to more diligent infection and prevention control, including careful PPE practices.

In addition, 5 studies reported increased risk of HCWs acquiring COVID-19 infection in other acute care settings. Of note, Cooper et al. (2020), Eyre et al. (2020), Galan et al. (2020), and Olanyanju et al. (2020) found that HCWs in the emergency department (ED) (OR ranging from 1.51 [95% CI: 1.01-2.27] to 3.151 [95% CI: 1.061-9.357]) and acute medicine settings (OR ranging from 1.52 [95% CI: 1.07–2.16] to 2.07 [95% CI: 1.31-3.25]) had statistically significant higher odds of acquiring COVID-19 infection relative to the study-specific reference groups. In the cross-sectional study conducted by Piapan et al. (2020) in a north-eastern province of Italy, the majority of HCWs infected with COVID-19 worked in medical wards, with significantly higher odds of infection among HCWs

in geriatric and infectious diseases (OR: 67.9, 95% CI: 34.7-133) and internal medicine (OR: 9.6, 95% CI: 5.6-16.5) (Piapan et al., 2020). It is important to note, however, the Piapan et al. (2020) article was characterized as a "Practice Points" piece; thus, methodological details of the study were not included and could not be critically evaluated. Olanyanju et al. (2020) also found that in their single-centre cross-sectional study, HCWs in obstetrics and gynecology showed significantly higher odds of COVID-19 seropositivity (OR: 19.286, 95% CI: 2.028-183.412) compared to those working in chemical pathology (the reference group). In a prospective cohort from 4 teaching hospitals, Eyre et al. (2020) observed increased odds of COVID-19 infection among HCWs in orthopaedics, trauma, rheumatology (aOR: 1.86, 95% CI: 1.26-2.74) and haematology and oncology (aOR: 1.88; 95% C: 1.27-2.78); the authors commented that because so few COVID-19 patients were admitted to these areas, this association reflected staff-based outbreaks in these specialties. For acute medical areas outside of COVID-19 cohort wards, Eyre et al., (2020) noted that "level-1" PPE precautions (i.e., fluid resistant surgical mask, gloves, apron, and optional eye protection) were only recommended for HCWs in contact with patients with confirmed or symptoms suggestive of COVID-19. The authors suspect this may have led to potential exposure by asymptomatic or pauci-symptomatic COVID-19 positive patients, resulting in greater odds of HCW infection in several acute medical wards (Eyre et al., 2020). None of the other studies provided sufficient details on PPE practices as they relate to increased risk or associations in the care areas evaluated.

Areas of care associated with decreased risk of COVID-19 infection among HCWs

Four studies reported that HCWs working in the intensive care unit (ICU) were significantly less likely to be positive for COVID-19 (Baxendale et al., 2020; Firew et al., 2020; Martin et al., 2020; Shields et al., 2020). Among those, two large cross-sectional studies reported adjusted ORs for COVID-19 infection among critical care HCWs ranging 0.28 (95% CI 0.09-0.78) (Shields et al., 2020) to 0.41 (95% CI: 0.27-0.6) (Martin et al., 2020) compared to HCWs in other acute care settings. Shields et al., (2020) suggested that the reasons underlying these findings are like multi-faceted; however, authors from both studies hypothesized that enhanced PPE requirements in the ICU setting (e.g., continuous use of respirators versus face masks, as in other acute settings) likely contributed to the decrease in risk among HCWs in the ICU (Martin et al., 2020; Shields et al., 2020). Firew et al. (2020) conducted a national cross-sectional survey of HCWs in the United States in May 2020 and found that HCWs in the ICU were about 27% less likely (prevalence ratio [PR]: 0.73, 95% CI: 0.58-0.92) to have COVID-19 compared to HCWs in the ED. The authors discussed how differences in environmental factors between ED (e.g., crowding and physical spacing of patients) compared to other acute care settings, including the ICU, may account for the observed findings (Firew et al., 2020). Baxendale et al. (2020) also reported that staff working with ICU patients were significantly less likely to acquire COVID-19 infection in comparison to staff in non-patient facing roles (β=-1.06, SE=0.44, Z=-2.39, p=0.017). Strict adherence to PPE guidelines (details not specified in the article) among critical care HCWs was thought to account for this difference (Baxendale et al., 2020). Interestingly, one case-control study comprised of participants randomly drawn from a India-wide COVID-19 testing data portal (Chatterjee et al., 2020), identified no statistically significant difference in COVID-19 infection among HCWs working in ICUs with COVID-19 positive or suspected patients (OR: 1.36, 95% CI: 0.88-2.1) compared to HCWs that were not (p=0.17) (Chatterjee et al., 2020).

No association between area of care and COVID-19 infection among HCWs

Lastly, two of the included studies found that the clinical areas where HCWs worked were not associated with HCW COVID-19 infections (Algado-Selles et al., 2020; Moscola et al., 2020). Algado-Selles et al. (2020) conducted a prospective cohort study comprised of HCWs in a tertiary hospital and 12 primary healthcare centres and found similar odds of COVID-19 diagnosis among HCWs in the ED, pediatric areas, critical care units, adult medical wards, primary health care and non-COVID-19 wards. Further, Moscola et al., (2020) identified no difference in the risk of testing positive for COVID-19 among HCWs in the ED, ICU, hospital units, and other locations from a cross-sectional survey administered in the New York state.

Evidence from the Alberta Health Services Healthcare Worker Testing Dashboard

Data from the Alberta Health Services Healthcare Worker Testing Dashboard from wave 1 of the COVID-19 pandemic in Alberta (and covering dates from March 5 – August 31, 2020) shows that most infections amongst healthcare workers were acquired outside of the workplace. SARS-CoV-2 infection affected healthcare workers

across a wide range of staffing categories and from a variety of care settings. These community acquired infections accounted for roughly 75-80% of all of the healthcare worker infections seen in wave 1 within AHS, Covenant Health, and Alberta Precision Laboratories.

Of those within AHS specifically who were identified as having had a workplace related source for their infection (occupationally acquired infections), the majority (97%) were amongst frontline clinical staff. There were 62 cases of COVID-19 in AHS healthcare workers were deemed to have been occupationally acquired and 32 cases of COVID-19 in AHS healthcare workers were of indeterminate cause.

Staffing categories:
Of the 62 cases that were confirmed as occupationally acquired, the majority were amongst registered nurses (n = 22), healthcare aides (n =15), and licensed practical nurses (n = 11). In addition, there were unit clerks (n = 4), physicians (n = 3), and less than three each of paramedics, social workers, recreational therapists, and administrative support or leaders.

Care locations:
Occupationally acquired infections linked to outbreaks in roughly 70-80% of cases. Acute care outbreaks occurred on the following unit types within AHS settings during wave 1:

- Psychiatry
- Obstetrics/labour and delivery
- COVID-19 ward
- Post-operative ward
- Transition ward (awaiting long term care)/general medicine ward
- Rural hospital inpatient medical ward

There were no occupationally acquired infections in emergency departments or intensive care units or surgical suites.

Evolving Evidence

Question 1: COVID-19 has particularly affected long-term care residents disproportionately during the pandemic. The literature related to risk factors (including community transmission) associated with transmission in these facilities reflects this. Most studies identified in this rapid review identified studies evaluating the role of community transmission in long-term care outbreaks. The NCCMT identified three systematic review protocols in PROSPERO, which will explore characteristics and risk factors associated with COVID-19 outbreaks and cases in long-term care. With the increasing community prevalence observed across jurisdictions, during this second wave of the pandemic, more hospital outbreaks are being reported. However, up until now, there have been few studies or reports describing the characteristics of these outbreaks, routes of transmission among nosocomial cases, and the role that community prevalence has on increasing COVID-19 burden and transmission within hospitals. We anticipate that the literature over the coming months will begin to address this gap.

Question 2: Based on the large number of guidelines, guidance documents, reports, and frameworks identified from both Canadian and international jurisdictions, there already exists a substantial amount of guidance for what PPE is required for HCWs treating acute care patients and LTC residents during the COVID-19 pandemic. However, given the evolving nature of the pandemic and increasing incidence and prevalence, updated guidelines for PPE requirements—particular with regards to forms of continuous PPE (beyond masking)—may develop. Alternatively, existing guidelines may evolve to explicitly consider jurisdictional challenges of PPE shortages as well.

Question 3: A significant number of primary studies and systematic reviews and meta-analyses have been reported looking at the efficacy and effectiveness of face masks and respirators; however very little evidence pertaining to face shields, and different levels of PPE. Most studies were conducted prior to the COVID-19 pandemic and given the imprecision and indirectness of the studies, firm conclusions and generalization of findings to the current COVID-19 pandemic are difficult. Currently, there are two RCTs during COVID-19 that plan

to recruit a total of 72,000 people. One will evaluate medical/surgical masks and the other cloth masks. In one of these trials, Canada is leading in recruitment of participants. Another study is ongoing and will recruit 576 people to compare N95/P2 respirators with medical surgical masks for healthcare workers during COVID-19. Finally, there are two ongoing studies of handwashing interventions in 395 children outside of COVID-19. Despite these ongoing studies, it will be particularly important to evaluate the role and impact of continuous masking, with or without the use of additional PPE (e.g. face shields).

Question 4: This rapid review identified extensive evidence of the physical discomfort that results from wearing PPE, especially N95 masks, for long periods of time. However, the no evidence was identified that described the effect of continuous PPE or full PPE mandates on healthcare worker behaviours, adherence or complacency. It is unclear if the effects of PPE mandates implemented during COVID-19 will have a lasting effect on HCW perception of PPE after the pandemic has subsided. Consideration should be given to the risks of not implementing higher-level PPE in non-COVID units. Although outside the scope of this review, numerous excluded studies described an increase in staff anxiety when they felt the recommended PPE was inadequate to protect them against disease transmission. If higher-level PPE is implemented as standard, it may be prudent to do periodic assessments of staff perception of PPE adequacy to mitigate stress related to personal safety concerns. Based on personal communication (J Conly), a RCT by Loeb et al.(McMaster University) evaluating medical masks compared to N95s during the COVID-19 pandemic is 40% enrolled and an independent safety monitoring group has seen NO safety risks to date.

Question 5: With the evolving nature of the COVID-19 pandemic itself, there is concomitant evolving evidence concerning the risk factors associated with HCWs infection, including the care areas wherein HCWs may be—if at all—at risk of acquiring COVID-19. One of the secondary literature sources that was hand-searched for this work (Chou et al., 2020) was described as a living rapid review (originally published on May 5, 2020) and identified 3 studies that examined various risk factors for acquiring COVID-19 among HCWs. Since that date, 5 updates of the living rapid review were completed (most recent completed October 20, 2020), and a total of 49 additional studies concerning potential risk factors for COVID-19 infection among HCWs were identified. Further iterations of this living rapid review would be worth reviewing to examine for potentially relevant articles to this current report.

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(If applicable) Date of re-assessment:

Authorship and Committee Members

This report was written by Jenine Leal, Lesley Soril, and Rachael Erdmann with assistance from Jamie Boyd. It was scientifically reviewed by Melissa Potestio, Stephanie Smith, Curtis Johnston, Peter Jamieson, Mark Joffe, Oscar Larios, Uma Chandran, Joseph Kim, Robyn Harrison, and Alexander Doroshenko. The full Scientific Advisory Group was involved in discussion and revisions of the document: Braden Manns (co-chair), Lynora Saxinger (co-chair), John Conly, Alexander Doroshenko, Shelley Duggan, Nelson Lee, Elizabeth MacKay, Andrew McRae, Melissa Potestio, Jeremy Slobodan, James Talbot, Brandie Walker, and Nathan Zelyas.

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Appendix

Sections

List of Abbreviations

AGMP: Aerosol-generating medical procedures
AHS: Alberta Health Services
aOR: Adjusted Odds Ratio
BC: British Columba
BiPAP: Bilevel Positive Airway Pressure
BMI: Body Mass Index
CDC: United States Centers for Disease Control and Prevention
CI: Confidence Interval
COVID-19: Coronavirus Disease-2019
CPAP: Continuous Positive Airway Pressure
ECDC: European Centre for Disease Control
ED: Emergency Department
ELISA: Enzyme-Linked Immunosorbent Assay
FFP: Face Filtering Piece
FRSM: Fluid-resistant surgical mask
GRADE: Grading of Recommendations, Assessment, Development and Evaluations
HCW: Healthcare Worker
ICU: Intensive Care Unit
ILI: Influenza-like Illness
IPC: Infection Prevention and Control
IRR: Incidence Rate Ratio
KCDC: Korean Centre for Disease Prevention and Control
KF94: Korean Filter 94 Respirator
KRS: Knowledge Resource Services
LTC: Long Term Care
MERS: Middle East Respiratory Syndrome
NCCMT: National Collaborating Centre for Methods and Tools
O&G: Obstetrics and Gynecology
OR: Odds Ratio
PARP: Powered Air-Purifying Respirator
PHAC: Public Health Agency of Canada
PPE: Personal Protective Equipment
PR: Prevalence Ratio
PRF: Particle Filter Respirator
RCT: Randomized controlled trial
RHA: Regional Health Authority
RR: Relative Risk / Risk Ratio
RT-PCR: Reverse Transcriptase Polymerase Chain Reaction
SAG: Scientific Advisory Group
SARS: Severe Acute Respiratory Syndrome
UK: United Kingdom
US: United States
WHO: World Health Organization
WHS: Workplace Health and Safety

Evidence Extraction Tables

Table 4. Summary of Included Guidelines and Guidance Documents Concerning PPE requirements in Acute Care Facilities

Jurisdiction/ Source	Document type Reference Version Date	COVID-19 Community Transmission Scenario	Care Setting	Guidance for Who & Activity	Patient COVID-19 Status	Recommended PPE Requirements	Other Guideline Comments[4]
CANADA							
British Columbia (BC) BC Centre for Disease Control (BC CDC)	PPE Framework (online) http://www.bccdc.ca/health-professionals/clinical-resources/covid-19-care/infection-control/personal-protective-equipment September 29, 2020	Not reported	In-patient acute care settings	All HCWs in direct physical contact with patient	Suspected and/or confirmed COVID-19 or have respiratory symptoms	Contact and droplet precautions: • Surgical/procedural mask • Eye protection (i.e., eye goggles or face shield) • Gloves • Gown	Engage in full PPE risk and point of care assessment
				All HCWs performing Aerosol-Generating Medical Procedures (AGMPs)	Suspected and/or confirmed COVID-19	Airborne precautions: • N95 respirator • Eye protection (face shield, safety glasses or goggles) • Gown • Gloves	
British Columbia Vancouver Coastal Health	Guidance document "PPE Recommendations – ACUTE"	Not reported	Acute/ Sub-acute inpatient settings, including inpatient surgical,	All HCWs providing direct patient care	Without symptoms and low-risk of COVID-19	• Procedure Mask • Eye Protection • Gloves	The same Mask and Eye Protection should be used between patient rooms and Common Clinical Spaces. Use of additional PPE should be as per standard non-COVID-19 Infection Control Routine Practices/Additional Precautions

[4] Text extracted verbatim from the source document

Jurisdiction/ Source	Document type Reference Version Date	COVID-19 Community Transmission Scenario	Care Setting	Guidance for Who & Activity	Patient COVID-19 Status	Recommended PPE Requirements	Other Guideline Comments[4]
	http://ipac.vch.ca/Documents/COVID-19/Dress%20Codes%20and%20PPE/PPE_Recommendations_%28Acute%29_V2.pdf April 15, 2020		medicine, hospitalist, pediatric, palliative, oncology, maternity, NICU, and in-patient psychiatry settings Peri-operative settings Ambulatory settings, including emergency department and outpatient clinics				Gloves should be changed between patients and doffed when leaving the patient care area
				All HCWs providing direct patient care	Suspected and/or confirmed COVID-19	Contact and droplet precautions: • Procedure mask • Eye protection (i.e., eye goggles or face shield) • Gloves • Gown	The same Mask and Eye Protection should be used between patient rooms and in the Shared and Common Clinical Spaces. Gowns and gloves should be doffed upon leaving patient care area
				All HCWs performing AGMPs	Suspected and/or confirmed COVID-19	Airborne + Contact and droplet precautions: • N95 Respirator or equivalent (Re-usable or disposable) • Eye Protection • Gown • Gloves	The same Respirator and Eye Protection should be used between patient rooms and Common Clinical Spaces. Gowns and gloves should be doffed upon leaving patient room

Jurisdiction/ Source	Document type Reference Version Date	COVID-19 Community Transmission Scenario	Care Setting	Guidance for Who & Activity	Patient COVID-19 Status	Recommended PPE Requirements	Other Guideline Comments[4]
		Not reported	COVID-19 units (non-critical care)	All HCWs providing direct patient care	Positive for COVID-19	Contact and droplet precautions: • Procedure mask • Eye protection (i.e., eye goggles or face shield) • Gloves • Gown	The same Mask and Eye Protection should be used between patient rooms and in the Shared and Common Clinical Spaces. The same gown can be used between COVID-positive patients in multi-patient rooms. Gloves should be changed between patients. Gloves and gowns should be doffed when leaving the patient care area
				All HCWs performing AGMPs	Positive for COVID-19	Airborne + Contact and droplet precautions: • N95 Respirator or equivalent (Re-usable or disposable) • Eye Protection • Gown • Gloves	The same Respirator and Eye Protection should be used between patient rooms and in the Common Clinical Spaces. The same gown can be used between COVID-positive patients in multi-patient rooms. Gloves should be changed between patients. Gloves and gowns should be doffed when leaving the AGMP room.

Jurisdiction/ Source	Document type Reference Version Date	COVID-19 Community Transmission Scenario	Care Setting	Guidance for Who & Activity	Patient COVID-19 Status	Recommended PPE Requirements	Other Guideline Comments[4]
		Not reported	Critical care units, including COVID-19-specific critical care units	Critical care HCWs providing direct patient care	Without symptoms and low- risk of COVID-19 infection	• Procedure Mask • Eye Protection • Gloves	The same Mask and Eye Protection should be used between patient rooms and in the Common Clinical Spaces. Use of additional PPE should be as per standard non-COVID- 19 Infection Control Routine Practices/Additional Precautions Gloves should be changed between patients and doffed when leaving the patient care area
				Critical care HCWs providing direct patient care	Patients positive for COVID-19	Droplet and Contact Precautions: • Procedure mask • Eye protection (i.e., eye goggles or face shield) • Gloves • Gown	The same Mask and Eye Protection should be used between patient rooms and in the Common Clinical Spaces. Gowns and gloves should be doffed upon leaving patient room
				Critical care HCWs performing AGMPs	Patients positive for COVID-19	Airborne + Contact and droplet precautions: • N95 Respirator or equivalent (Re-usable or disposable) • Eye Protection • Gown • Gloves	The same Respirator and Eye Protection should be used between patient rooms and in the Common Clinical Spaces. Gloves and gowns should be doffed when leaving the AGMP room.

Jurisdiction/ Source	Document type Reference Version Date	COVID-19 Community Transmission Scenario	Care Setting	Guidance for Who & Activity	Patient COVID-19 Status	Recommended PPE Requirements	Other Guideline Comments[4]
Manitoba Shared Health	Guidance document "Provincial Requirements for Personal Protective Equipment (PPE)" https://sharedhealthmb.ca/files/covid-19-provincial-ppe-requirements.pdf July 14, 2020	Not reported	Acute/Sub-Acute patient rooms, including Hemodialysis, Emergency, and Urgent Care patient rooms (excluding Operating Rooms and Recovery Rooms)	All HCWs providing direct patient care	COVID-19 Non-Suspect	• Procedure mask • Eye protection • Gloves as per routine practices • Gowns as per routine practices	Extended use of same mask for repeated interactions with multiple patients. Store and reuse same procedure mask following coffee break (s) unless caring for patient requiring additional precautions for respiratory viruses; change mask following meal break Change mask if it becomes wet, damaged, or soiled Eye protection to be used throughout the shift with appropriate cleaning and disinfecting protocols. Remove and clean/disinfect at breaks and at end of shift. Wherever possible, retain face shields, lenses and/or frames and disinfect eye protection at the end of the shift. Gowns are to be used as per routine practices (e.g. MRSA, Scabies, blood or body fluid contact or excessive soiling) AND in situations requiring additional precautions Gloves are not required for every patient interaction however meticulous attention to hand hygiene is required. Gloves should only be applied as per routine practices and additional precautions (e.g. MRSA, Scabies, blood or body fluid contact or excessive soiling)

Jurisdiction/ Source	Document type Reference Version Date	COVID-19 Community Transmission Scenario	Care Setting	Guidance for Who & Activity	Patient COVID-19 Status	Recommended PPE Requirements	Other Guideline Comments[4]
					COVID-10 Positive or Suspect	• Procedure mask or N95 respirator if point of care risk assessment indicates use • Eye protection • Gloves as per routine practices • Gowns as per routine practices	Extended use of same mask, eye protection for repeated interactions with multiple patients; discard and replace mask following breaks. Change mask if it becomes wet, damaged, soiled and/or at breaks. With COVID-19 Positive and/or Suspect-patients if point of care risk assessment indicates use of N95, extend use of same N95 respirator, for repeated interactions with multiple patients. Change respirator if it becomes wet, damaged, soiled and/or at breaks and/or post intubation. Eye protection to be used throughout the shift with appropriate cleaning and disinfecting protocols. Remove and clean/disinfect at breaks and at end of shift. Wherever possible, retain face shields, lenses and/or frames and disinfect eye protection at the end of the shift. With COVID-19 Positive-patients, extend use of gowns except in situations when gowns should be used as per routine practices (e.g. MRSA, Scabies, blood or body fluid contact or excessive soiling) AND in situations requiring additional precautions. Remove gown prior to leaving the COVID-19 Positive unit. With COVID-19 Suspect-patients, gowns are to be used as per routine practices and

Jurisdiction/ Source	Document type Reference Version Date	COVID-19 Community Transmission Scenario	Care Setting	Guidance for Who & Activity	Patient COVID-19 Status	Recommended PPE Requirements	Other Guideline Comments[4]
							additional precautions(e.g. MRSA, Scabies, blood or body fluid contact or excessive soiling). With COVID-19 Positive AND Suspect-patients, gloves must be applied and changed per Routine Practices and Additional Precautions (e.g. MRSA, scabies, blood or body fluid contact or excessive soiling). Hand Hygiene before/after donning/doffing gloves or contact with patient or patient environment without gloves
		Not reported	Outpatient facilities, including Emergency and Urgent Care	Patients	Without respiratory symptoms	PPE not required	Reinforce Hand Hygiene
					With respiratory symptoms	If patient is not wearing their own or homemade mask, provide mask	
		Not reported	Inpatient facilities – Patient Room	Patients	Without respiratory symptoms	PPE not required	Reinforce Hand Hygiene
					With respiratory symptoms	PPE not required	Reinforce Hand Hygiene
		Not reported	Inpatient facilities – Patient Room	Patients	Without respiratory symptoms	PPE not required	Reinforce Hand Hygiene
					With respiratory symptoms	Procedure mask, if no artificial airway and if tolerated N100 filter, if an artificial airway	

Jurisdiction/ Source	Document type Reference Version Date	COVID-19 Community Transmission Scenario	Care Setting	Guidance for Who & Activity	Patient COVID-19 Status	Recommended PPE Requirements	Other Guideline Comments[4]
		Not reported	All Acute and Sub-Acute Care Settings, including Operating Room and Recovery	All HCWs performing AGMPs	COVID-19 Non-Suspect	• Procedure mask • Eye protection • Gloves • Gown	N95 respirators are not required for AGMPs, unless: • There is clinical concern of infection with an airborne pathogen such as Mycobacterium tuberculosis; OR • The patient is demonstrating new onset of respiratory symptoms of an infectious nature and is being assessed for COVID-19 testing and as a result, their status is being changed to COVID-19 suspect Extended use of same mask. Change mask or respirator if it becomes wet, damaged, soiled and/or at breaks and/or post intubation. Eye protection to be used throughout the shift with appropriate cleaning and disinfecting protocols. Remove and clean/disinfect at breaks and at end of shift. Wherever possible, retain face shields, lenses and/or frames and disinfect eye protection at the end of the shift. Hand Hygiene before/after donning/doffing gloves or contact with patient or patient environment without gloves
					COVID-19 Positive or Suspect	• N95 respirator • Eye protection • Gloves • Gown	Extend N95 respirator (COVID-19 Positive and/orCOVID-19 Suspect-patients), eye protection for repeated interactions with multiple patients

Jurisdiction/ Source	Document type Reference Version Date	COVID-19 Community Transmission Scenario	Care Setting	Guidance for Who & Activity	Patient COVID-19 Status	Recommended PPE Requirements	Other Guideline Comments[4]
							Change respirator if it becomes wet, damaged, soiled and/or at breaks and/or post intubation. Eye protection to be used throughout the shift with appropriate cleaning and disinfecting protocols. Remove and clean/disinfect at breaks and at end of shift. Wherever possible, retain face shields, lenses and/or frames and disinfect eye protection at the end of the shift. With COVID-19 Positive-patients, extend use of gowns except in situations when Gowns should be used as per routine practices (e.g. MRSA, Scabies, blood or body fluid contact or excessive soiling) AND in situations requiring additional precautions. Remove gown prior to leaving the COVID-19 Positive unit. With COVID-19 Suspect-patients, gowns are to be used as per routine practices and additional precautions(e.g. MRSA, Scabies, blood or body fluid contact or excessive soiling). With COVID-19 Positive AND Suspect-patients, gloves must be applied and changed per Routine Practices and Additional Precautions (e.g. MRSA, scabies, blood or body fluid contact or excessive soiling).

Jurisdiction/ Source	Document type Reference Version Date	COVID-19 Community Transmission Scenario	Care Setting	Guidance for Who & Activity	Patient COVID-19 Status	Recommended PPE Requirements	Other Guideline Comments[4]
							Hand Hygiene before/after donning/doffing gloves or contact with patient or patient environment without gloves
		Not reported	COVID-19 Unit (ICU or Designated Ward)	All HCWs performing any and all activities	COVID-19 Positive or Suspect	• Procedure mask • Eye protection • Gown • Gloves	Extended use of same mask, eye protection and gown without removal for repeated interactions with multiple patients; discard and replace mask following breaks. Change mask if it becomes wet, damaged, soiled and/or at breaks. With COVID-19 Positive and/or Suspect-patients if point of care risk assessment indicates use of N95, extend use of same N95 respirator, for repeated interactions with multiple patients. Change respirator if it becomes wet, damaged, soiled and/or at breaks and/or post intubation. Eye protection to be used throughout the shift with appropriate cleaning and disinfecting protocols. Remove and clean/disinfect at breaks and at end of shift. Wherever possible, retain face shields, lenses and/or frames and disinfect eye protection at the end of the shift. Extended use of gowns between COVID-19 Positive-patients except in situations when Gowns should be used as per routine practices (e.g. MRSA, Scabies, blood or

Jurisdiction/ Source	Document type Reference Version Date	COVID-19 Community Transmission Scenario	Care Setting	Guidance for Who & Activity	Patient COVID-19 Status	Recommended PPE Requirements	Other Guideline Comments[4]
							body fluid contact or excessive soiling) AND in situations requiring additional precautions. Remove gown prior to leaving the COVID-19 Positive unit. Gloves are to be worn in all areas (e.g. halls) in the unit. Where there is no direct patient contact, use of Gloves may be extended. Staff who are in/out of the patient room without physical contact, a change in gloves would not be required. Where there is direct patient contact gloves must be changed when leaving the room. If patient has a secondary illness requiring Routine Practices and Additional Precautions, gloves are to be used and changed as per the specific practice. Hand Hygiene before/after donning/doffing gloves.
Ontario Public Health Ontario	Technical Brief "IPAC Recommendations for Use of Personal Protective Equipment for Care of Individuals with Suspect or	Not reported	Any acute care setting	All HCWs interacting with any patient	Negative for COVID-19	Surgical or procedural mask	This guidance is intended to inform minimum expectations for PPE; however, HCWs should refer to and follow their own institutional or organizational infection prevention and control policies and procedures on PPE, as well as consider their local epidemiology to help inform their decision of a suspect case. HCWs should perform a PCRA for patient encounters. **For every patient and/or patient environment encounter, apply the Four Moments for Hand Hygiene**

Jurisdiction/ Source	Document type Reference Version Date	COVID-19 Community Transmission Scenario	Care Setting	Guidance for Who & Activity	Patient COVID-19 Status	Recommended PPE Requirements	Other Guideline Comments[4]
	Confirmed COVID-19" https://www.publichealthontario.ca/-/media/documents/ncov/updated-ipac-measures-covid-19.pdf?la=en July 27, 2020						(https://www.publichealthontario.ca/-/media/documents/B/2014/bp-hand-hygiene.pdf?la=en). * Universal masking for source control (i.e. to protect others from the mask wearer) is a current practice for HCWs in Ontario.
		Not reported	Any acute care setting	Patients	Confirmed or suspected COVID-19	Provide surgical/procedure mask if tolerated.	Maintain spatial distance of at least 2 m or separation by physical barrier. Patient to perform hand hygiene.
		Not reported	Inpatient facility – patient room	All HCW providing direct care, including nasopharynx-geal and oropharyngeal swab collection	Confirmed or suspected COVID-19	Perform point-of-care risk assessment Droplet and Contact Precautions, including: • Surgical/procedure mask • Isolation gown • Gloves • Eye protection (goggles or face shield)	
				All HCW performing AGMPs	Confirmed or suspected COVID-19	Airborne, Droplet and Contact Precautions, including: • N95 respirator (fit-tested, seal-checked) • Isolation gown • Gloves • Eye protection (goggles or face shield) • Negative pressure room, if available	

Jurisdiction/ Source	Document type Reference Version Date	COVID-19 Community Transmission Scenario	Care Setting	Guidance for Who & Activity	Patient COVID-19 Status	Recommended PPE Requirements	Other Guideline Comments[4]
		Not reported	Ambulatory and Outpatient Facilities - Consultation room/area	All HCWs performing physical examination	Confirmed or suspected COVID-19	Droplet and Contact Precautions, including: • Surgical/procedure mask • Isolation gown • Gloves • Eye protection (goggles or face shield)	
				Patients	Confirmed or suspected COVID-19	Provide surgical/procedure mask if tolerated.	Provide surgical/procedure mask if tolerated. Perform hand hygiene
Ontario Ontario Health	Guidance document "Infection Prevention and Control (IPAC) for Scheduled Surgeries and Procedures During the COVID-19 Pandemic" https://www.ontariohealth.ca/sites/ontariohealth/files/2020-06/COVID-19%20Infection%20Prevention%20and%20Control%20for%20Scheduled%20Surgeries%20and%20Proc	Not reported	Pre-assessment unit and Day surgery	All HCWs providing pre-operative care	Passed screening or negative for COVID-19	Surgical or procedural mask	
		Not reported	Operating room or procedural suite	Intubation team and Surgical/ Procedural team	Passed screening or negative for COVID-19	• Surgical mask • Eye protection • Gown • Gloves	Point-of-care risk assessment (PCRA) must be performed by every health care worker before every patient interaction, including surgeries and procedures

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	edures_8June2020.pdf June 8, 2020						
Ontario Ontario Health	Guidance Document "Personal Protective Equipment (PPE) Use During the COVID-19 Pandemic" https://www.ontariohealth.ca/sites/ontariohealth/files/2020-05/Ontario%20Health%20Personal%20Protective%20Equipment%20Use%20During%20the%20COVID-19%20Pandemic_rev10May20%20PDF_v2.pdf August 11, 2020	Not reported	Any acute care setting	All HCWs interacting with any patient	Negative for COVID-19	Surgical or procedural mask	
		Not reported	Any acute care setting	Patients	Negative for COVID-19	Mask (cloth or surgical/procedure mask)	

Jurisdiction/ Source	Document type Reference Version Date	COVID-19 Community Transmission Scenario	Care Setting	Guidance for Who & Activity	Patient COVID-19 Status	Recommended PPE Requirements	Other Guideline Comments[4]
Saskatchewan Saskatchewan Health Authority	PPE Guidelines "CONTINUOUS and EXTENDED USE PPE GUIDELINES when caring for Patients suspected or confirmed to have COVID-19 in Acute Care" https://www.saskhealthauthority.ca/news/service-alerts-emergency-events/covid-19/PPE-infection-prevention-control/Documents/Personal%20Protective%20Equipment/Recommendations/CV-19-G0006-Continuous-and-Extended-PPE-Use-Guidelines-Acute-Care.pdf July 7, 2020	Not reported	Inpatient Rooms and Emergency Department Setting	All HCWs providing direct patient care	Suspected or confirmed COVID-19	• Face Mask • Eye Protection • Gown • Gloves	Mask: Change IF it becomes wet, soiled, or damaged. Discard when taking a scheduled break and at end of shift Eye Protection: Remove/disinfect before a scheduled break and at the end of shift. Discard face shield at the end of shift Gown and gloves: Change between each patient encounter Perform hand hygiene according to SHA Hand Hygiene Policy
				All HCWs performed AGMPs	Suspected or confirmed COVID-19	• N95 respirator (fit-tested, seal checked) • Eye Protection • Gown • Gloves	N95 respirator: Extend use for multiple AGMPs. Change N95 respirator IF it becomes wet, damaged, or soiled. Discard when taking a scheduled break and at end of shift N95 respirator: Extend use for single AGMP. Change N95 respirator IF it becomes wet, damaged, or soiled. Discard when taking a scheduled break and return to continuous mask use guidelines Eye Protection: Remove/disinfect before a scheduled break and at the end of shift. Discard face shield at the end of shift Gown and gloves: Change between each patient encounter Perform hand hygiene according to SHA Hand Hygiene Policy

Jurisdiction/ Source	Document type Reference Version Date	COVID-19 Community Transmission Scenario	Care Setting	Guidance for Who & Activity	Patient COVID-19 Status	Recommended PPE Requirements	Other Guideline Comments[4]
	PPE Guidelines "CONTINUOUS and EXTENDED USE PPE GUIDELINES when caring for Patients confirmed to have COVID-19 in Designated Units/Rooms" https://www.saskhealthauthority.ca/news/service-alerts-emergency-events/covid-19/PPE-infection-prevention-control/Documents/Personal%20Protective%20Equipment/Recommendations/CV19G0038PPEGuidelinesWhenCaringforPatientsResidentsConfirmedtohaveCOVID19inDesignatedUnitsCohortedS.pdf July 7, 2020	Not reported	COVID-19 Designated Unit/Rooms	All HCWs providing direct patient care	Confirmed COVID-19	• Face mask • Eye protection • Gown • Gloves	Mask: Change IF it becomes wet, soiled, or damaged. Discard when taking a scheduled break and at end of shift Eye Protection: Remove/disinfect before a scheduled break and at the end of shift. Discard face shield at the end of shift Gown: Change when wet or soiled. Remove before entering common clinical spaces, before breaks and at end of shift Gloves: Change between each patient encounter Perform hand hygiene according to SHA Hand Hygiene Policy
				All HCWs performing AGMPs	Confirmed COVID-19	• N95 respirator (fit-tested, seal checked) • Eye Protection • Gown • Gloves	N95 respirator: Extend use for multiple AGMPs. Change N95 respirator IF it becomes wet, damaged, or soiled. Discard when taking a scheduled break and at end of shift N95 respirator: Extend use for single AGMP. Change N95 respirator IF it becomes wet, damaged, or soiled. Discard when taking a scheduled break and return to continuous mask use guidelines Eye Protection: Remove/disinfect before a scheduled break and at the end of shift. Discard face shield at the end of shift

Jurisdiction/ Source	Document type Reference Version Date	COVID-19 Community Transmission Scenario	Care Setting	Guidance for Who & Activity	Patient COVID-19 Status	Recommended PPE Requirements	Other Guideline Comments[4]
							Gown: Change when wet or soiled. Remove before entering common clinical spaces, before breaks and at end of shift Gloves: Change between each patient encounter Perform hand hygiene according to SHA Hand Hygiene Policy
	PPE Guidelines "Infection Prevention and Control Masking Guidelines for Patients" https://www.saskhealthauthority.ca/news/service-alerts-emergency-events/covid-19/PPE-infection-prevention-control/Documents/Personal%20Protective%20Equipment/Recommendations/CV-19-G0043-Masking-Guidelines-for-Patients-Residents-Clients.pdf	Not reported	All clinical areas, including Emergency department/Urgent care, Outpatient areas (ambulatory care, laboratory, day surgery, physiotherapy, dialysis, diagnostic imaging, etc.), Acute care inpatient units (excluding patient room), and during transport for test/procedure	Patients	All patients	Medical mask, if tolerated	Patients must perform hand hygiene: • When entering and exiting the facility • Before leaving room and upon return Patients should be advised not to touch the outside of the mask. If they touch or adjust their face mask, they must immediately perform hand hygiene. Patients should be provided with a new mask if it becomes wet, soiled or damaged.

Jurisdiction/ Source	Document type Reference Version Date	COVID-19 Community Transmission Scenario	Care Setting	Guidance for Who & Activity	Patient COVID-19 Status	Recommended PPE Requirements	Other Guideline Comments[4]
	October 29, 2020						
Canada-wide Public Health Agency of Canada (PHAC)	Guidance document “Infection prevention and control for COVID-19: Second interim guidance for acute healthcare settings” https://www.canada.ca/en/public-health/services/diseases/2019-novel-coronavirus-infection/health-professionals/infection-prevention-control-covid-19-second-interim-guidance.html#a8.7 April 30, 2020	Not reported	Direct patient care areas (including within 2 metres of healthcare workers [HCW] and patients)	All HCWs for all encounters	Patients presenting with a fever and/or a new or worsening cough or acute respiratory illness	Droplet and contact precautions: • Gloves • Long-sleeved cuffed gown (covering front of body from neck to mid-thigh) • Mask • Face or eye protection	All HCWs should properly put on PPE prior to entering the patient's room or bed space (within 2 metres of a patient with COVID-19). PPE for routine practices, droplet and contact precautions, and an N95 respirator when required for an AGMP, should be put on and removed according to the facility protocol as outlined on posters illustrating correct methods for putting on and removing PPE located inside and outside the patient room. PPE should be discarded prior to exiting the patient's room or ante-room.
				All HCWs in the room during AGMPs	Suspected or confirmed COVID-19	• Fit-tested, seal-checked N95 respirator • Gloves • Gown • Face or eye protection	Follow provincial or territorial guidance for other procedures that require the use of an N95 respirator. This guidance may vary among provinces and territories. Patient should be placed in an AIIR if one is available on the unit. If no AIIR is available on the unit, the patient should be placed in a private room. The door of the room should be

Jurisdiction/ Source	Document type Reference Version Date	COVID-19 Community Transmission Scenario	Care Setting	Guidance for Who & Activity	Patient COVID-19 Status	Recommended PPE Requirements	Other Guideline Comments[4]
							closed when an AGMP is being performed. Transfers between units should not occur unless medically necessary
		Not reported	Throughout healthcare facility, including transfers within and between facilities	Patients	Suspected or confirmed COVID-19	Mask, may be removed in once in private room with contact and droplet precautions	
Canada-wide PHAC	Technical Brief "COVID-19 technical brief: Masking and face shields for full duration of shifts in acute healthcare settings" https://www.canada.ca/en/public-health/services/diseases/2019-novel-coronavirus-infection/health-professionals/technical-brief-	Not reported	All healthcare settings	All HCWs working in direct patient care areas for full duration of shifts	All patients' status	• Masking *is recommended* • Use of eye protection (e.g., a face shield) is *strongly considered*	Consider these measures due to increasing prevalence of COVID-19 infection Refer to provincial and territorial guidance and facility policies on specific recommendations for use of masks, eye protection, and other PPE, and PPE conservation strategies. When masks and face shields are recommended for full-duration of shifts: • Perform hand hygiene before they put on their mask and face shield when they enter the acute healthcare facility or patient care area, and before and after removal • Wear a mask securely over their mouth and nose and adjust the nose piece to fit snugly

Jurisdiction/ Source	Document type Reference Version Date	COVID-19 Community Transmission Scenario	Care Setting	Guidance for Who & Activity	Patient COVID-19 Status	Recommended PPE Requirements	Other Guideline Comments[4]
	masking-face-shields-full-duration-shifts-acute-healthcare-settings.html April 15, 2020						• Not touch the front of mask or face shield while wearing it (and immediately perform hand hygiene if this occurs) • Not dangle the mask under their chin, around their neck, off the ear, under the nose or place on top of head • Ensure that gloves and a long-sleeved cuffed gown (covering front of body from neck to mid-thigh), are donned prior to entering the room or within 2 metres of any patient on Droplet and Contact precautions After seeing a patient on Droplet and Contact precautions: • Gloves should be discarded in the nearest no-touch waste receptacle, and should never be re-worn • Disposable gowns should be discarded in the nearest no-touch waste receptacle, and reusable gowns processed as per facility protocols • Full face shields should be removed (to be reprocessed or disposed of as per facility infection prevention and control guidance) *If masks with attached visors are used these should be removed and discarded in the nearest no-touch waste receptable, and a new mask and eye protection donned • If multiple patients are seen on units dedicated to confirmed COVID-19-positive patients, face shields or masks with attached visors do not need to be

Jurisdiction/ Source	Document type Reference Version Date	COVID-19 Community Transmission Scenario	Care Setting	Guidance for Who & Activity	Patient COVID-19 Status	Recommended PPE Requirements	Other Guideline Comments[4]
							removed between patients unless soiled, or if the mask is damaged, wet, damp, or has touched a patient • Hand Hygiene must be performed during and after PPE removal and between patient encounters
INTERNATIONAL							
Australia Government of Australia	Guidance document "Guidance on the minimum recommendations for the use of personal protective equipment (PPE) in hospitals during the COVID-19 outbreak" https://www.health.gov.au/resources/publications/guidance-on-the-use-of-personal-protective-equipment-ppe-in-hospitals-during-the-covid-19-outbreak	No or low community transmission	In hospital settings	All HCWs performing routine care and performing AGMPs	Not suspected or confirmed COVID-19 cases	Standard infection prevention and control precautions, including use of PPE based on risk assessment When performing AGMPs, typically: • Gown • Surgical mask • Eye protection gloves • Head covering (if required as regular theatre attire)	PPE should be used in accordance with the Australian Guidelines for the Prevention and Control of Infection in Healthcare (2019).
			In-hospital settings, including Intensive care units, COVID wards, general wards, emergency departments and operating rooms	All HCWs providing routine patient care	Suspected or confirmed COVID-19 (including critically ill patients)	Contact and droplet precautions at minimum: • Gowns/Aprons • Surgical mask* • Eye protection • Gloves • Boot/shoe covers • Head covers	Gown / Aprons • Long-sleeved, preferably fluid-resistant, gown or apron. • A launderable cloth gown or apron is adequate when direct physical contact is minimal and/or the risk of blood or body fluid splash is low (e.g. observations, medication delivery). Surgical mask • Varying levels of fluid resistant surgical masks are available.

Jurisdiction/ Source	Document type Reference Version Date	COVID-19 Community Transmission Scenario	Care Setting	Guidance for Who & Activity	Patient COVID-19 Status	Recommended PPE Requirements	Other Guideline Comments[4]
	November 9, 2020						• When the likelihood of exposure to blood or body fluid is low, in routine care, a level 1 surgical mask is acceptable. Level 2 or 3 masks should be used when there is a risk of blood or body fluid exposure and in the operating theatre Eye protection • Face shield, wrap-around safety glasses, visor or goggles. Note prescription glasses do not represent safety eye wear and additional eye protection is recommended Gloves • Disposable non-sterile gloves when in direct contact with patients (use hand hygiene before donning and after removing gloves). Boot/Shoe Covers • Use of boots or shoe covers is not recommended unless gross contamination is anticipated or they are required as standard attire in operating theatre or trauma room. Head Covers • Long hair should be securely tied back. • Head covering is not required except as part of standard operating theatre attire or when performing a sterile/aseptic procedure (e.g. central line insertion). A head covering may be used to contain hair or for comfort reasons (e.g. to form a barrier for straps from masks or face shields).

Jurisdiction/ Source	Document type Reference Version Date	COVID-19 Community Transmission Scenario	Care Setting	Guidance for Who & Activity	Patient COVID-19 Status	Recommended PPE Requirements	Other Guideline Comments[4]
			In-hospital settings, including Intensive care units, COVID wards, general wards, emergency departments and operating rooms	All HCWs performing AGMPs or providing routine care to patients with cognitive impairment or exhibiting challenging behaviours	Suspected or confirmed COVID-19 (including critically ill patients)	Contact and airborne precautions: • Gowns/Aprons • Particle filter respirator (PFR), such as a P2 or N95 respirator • Eye protection • Gloves • Boot/shoe covers • Head covers	If a health care worker is required to remain in an ICU patient's room **for a long period (e.g. more than one hour)** to perform multiple AGPs, the use of a Powered Air Purifying Respirators (PAPR) may be considered, as an alternative, for greater comfort and visibility.
			Birthing suite	Patient	Suspected or confirmed COVID-19	Surgical mask, if tolerated	
Australia Government of Australia	Guidance document "Recommended minimum requirements for the use of masks or respirators by health and residential care workers in areas with significant community transmission of COVID-19" https://www.health.gov.au/resource	Significant Community Transmission	All in-hospital settings	All HCWs providing routine patient care	Not suspected or confirmed COVID-19 cases	**Universal use of surgical mask**, along with standard infection precautions and eye protection	
					Suspected or confirmed COVID-19, or are in quarantine, or have acute respiratory symptoms	Contact and droplet precautions and eye protection: • Gowns/Aprons • Surgical mask • Eye protection • Gloves • Boot/shoe covers • Head covers	
			In-hospital settings	All HCWs performing AGMPs	Suspected or confirmed COVID-19	Contact, droplet and airborne precautions and eye protection: • Gowns/Aprons • Particle filter respirator (PFR), such as a P2 or N95 respirator	Avoid unnecessary AGMP Ensure procedures occur in a closed door single negative pressure room, if available.

Jurisdiction/ Source	Document type Reference Version Date	COVID-19 Community Transmission Scenario	Care Setting	Guidance for Who & Activity	Patient COVID-19 Status	Recommended PPE Requirements	Other Guideline Comments[4]
	s/publications/iceg-guidance-masks-respirators-health-residential-care-workers October 23, 2020					• Eye protection • Gloves • Boot/shoe covers • Head covers	Ensure only essential health and care workers are in the room during the procedure. Leave the room empty for at least 30 minutes after the procedure,8 and undertake environmental cleaning.
			In-hospital settings, including COVID-19 wards, emergency department, other in-patient wards where there are high numbers of suspected or confirmed COVID-19 patients	All HCWs providing routine care to patients with cognitive impairment, unable to cooperate, or exhibiting challenging behaviours	Suspected or confirmed COVID-19	*May consider* using contact and droplet precautions (i.e. gown, gloves, protective eyewear) with a PFR instead of a surgical mask	Use of a PFR for up to four hours
New Zealand New Zealand Ministry of Health	Guidance document/matrix "Personal Protective Equipment (PPE) for staff caring for COVID-19 patients in hospital" https://www.health.govt.nz/our-	Not reported	All clinical areas	All HCWs providing routine patient care	Probable or confirmed COVID-19	Contact and droplet precautions: • Medical mask • Eye protection (goggles or face shield) • Fluid-resistant long sleeve gown • Plastic apron • Non-sterile gloves	Standard Precautions2 including the 5 moments for hand hygiene3 apply for all patients with an acute respiratory infection.
				All HCWs performing AGMPs	Probable or confirmed COVID-19	Contact and Airborne Precautions: • N95 or P2 mask	AGPs should not be performed in cohort bay

Jurisdiction/ Source	Document type Reference Version Date	COVID-19 Community Transmission Scenario	Care Setting	Guidance for Who & Activity	Patient COVID-19 Status	Recommended PPE Requirements	Other Guideline Comments[4]
	work/diseases-and-conditions/covid-19-novel-coronavirus/covid-19-information-specific-audiences/covid-19-personal-protective-equipment-workers/personal-protective-equipment-use-health-and-disability-care-settings September 22, 2020					• Eye protection (goggles or face shield) • Fluid-resistant long sleeve gown • Plastic apron • Non-sterile gloves	
Korea Korean Center for Disease Prevention and Control (KCDC)	Guidelines[5] "Infection prevention and control for novel coronavirus infection"	Not reported	All in-patient care settings	All HCWs providing examination or routine patient care	COVID-19 positive	• KF94 mask or equivalent respirator • Eye protection (goggles or face shield) • Gown (long-sleeved, fluid-resistant gown) or coveralls with foot covers • Gloves	

[5] Information obtained from Park SH. Personal Protective Equipment for Healthcare Workers during the COVID-19 Pandemic. Infect Chemother. 2020 Jun;52(2):165-182 https://doi.org/10.3947/ic.2020.52.2.165

Jurisdiction/ Source	Document type Reference Version Date	COVID-19 Community Transmission Scenario	Care Setting	Guidance for Who & Activity	Patient COVID-19 Status	Recommended PPE Requirements	Other Guideline Comments[4]
	https://cheongju.go.kr/www/selectBbsNttView.do?key=280&bbsNo=510&nttNo=145181&integrDeptCode=000100101 February 2020			All HCWs are performing AGMPs or collecting specimens (not involving AGMPs)	COVID-19 positive	• KF94 mask or equivalent respirator, or powered air-purifying respirator (PARP) • Eye protection (goggles or face shield) • Gown (long-sleeved, fluid-resistant gown) or coveralls with foot covers • Gloves	
European Union Countries and the United Kingdom European Centre for Disease Control	Technical Report "Guidance for wearing and removing personal protective equipment in healthcare settings for the care of patients with suspected or confirmed COVID-19" https://www.ecdc.europa.eu/en/publications-data/guidance-wearing-and-removing-personal-protective-equipment-	Not reported	All healthcare settings	HCWs and infection prevention and control personnel with direct patient contact	Suspected or Confirmed COVID-19	Minimal PPE set to protect from contact, droplet and airborne transmission: • Class 2 or 3 filtering face-piece (FFP) respirators (FFP2 or FFP3) • Goggles (or face shield) • Long-sleeved water-resistant gown • Gloves	Because different types of respirators fit differently between users, the respirator requires a fitting test. Face masks (surgical masks) recommended in case of shortage of respirators and on a case-by-case assessment. Surgical masks do not require fit testing Goggles need to fit the user's facial features and have to be compatible with the respirator Gowns do not need to be sterile unless it is used in a sterile environment (e.g. operating room). If water-resistant gowns are not available, a single-use plastic apron worn over the non-water-resistant gown can be used.
				HCWs performing AGMPs	Suspected or Confirmed COVID-19	Minimal PPE set to protect from contact, droplet and airborne transmission: • A FFP3 respirator should be always used	

Jurisdiction/ Source	Document type Reference Version Date	COVID-19 Community Transmission Scenario	Care Setting	Guidance for Who & Activity	Patient COVID-19 Status	Recommended PPE Requirements	Other Guideline Comments[4]
	healthcare-settings February 2020					• Goggles (or face shield) • Long-sleeved water-resistant gown • Gloves	
United Kingdom Department of Health and Social Care (DHSC), Public Health Wales (PHW), Public Health Agency (PHA) Northern Ireland, Health Protection Scotland (HPS)/National Services Scotland, Public Health England (PHE) and NHS England	Official guidance "COVID-19: Guidance for the remobilisation of services within health and care settings Infection prevention and control recommendations" https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/910885/COVID-19_Infection_prevention_and_control_guidance_FINAL_PDF_20082020.pdf August 20, 2020	Not reported	All healthcare settings	All HCWs performing routine patient care and If contact with blood and/or body fluids is anticipated, including AGMPs	COVID-19 negative and asymptomatic Referred to as LOW RISK PATHWAY (see comments for description)	• Surgical mask Type II for extended use throughout healthcare facility • Fluid-resistant surgical face mask (FRSM) Type IIR for direct patient care • Disposable gloves • Disposable apron/gown • Risk assess use of eye/face protection (visor)	LOW RISK PATHWAY: a) Individuals triaged/clinically assessed prior to treatment (inpatient/outpatient) with no COVID-19 contacts or symptoms who have isolated/shielded AND b) patients who have a negative SARS-CoV-2 (COVID-19) test result within 72 hours of care and, for planned admissions, have self-isolated since the test date OR c) individuals who have recovered from COVID-19 AND have had at least 3 consecutive days without fever or respiratory symptoms AND a negative SARS-CoV-2 test result OR d) patients or individuals in any care facility where testing is undertaken regularly (remains negative) Airborne precautions are NOT required for AGPs on patients/individuals in the low risk COVID-19 pathway, providing the patient has no other infectious agent transmitted via the droplet or airborne route.
		Not reported	All healthcare settings	All HCWs providing	No COVID-19 symptoms and no test results	Contact and Droplet precautions: • FRSM Type IIR • Disposable gloves	MEDIUM RISK PATHWAY a) any facility where triaged/clinically assessed individuals are asymptomatic and

Jurisdiction/ Source	Document type Reference Version Date	COVID-19 Community Transmission Scenario	Care Setting	Guidance for Who & Activity	Patient COVID-19 Status	Recommended PPE Requirements	Other Guideline Comments[4]
				direct patient care	Referred to as MEDIUM RISK PATHWAY (see comments for description)	• Disposable apron or gown, gown required if risk of spraying / splashing • Eye/face protection (visor)	are waiting a SARS-CoV-2 (COVID-19) test result and have no known recent COVID-19 contact OR b) any care facility where testing is not required or feasible on asymptomatic individuals and therefore infectious status is unknown OR c) asymptomatic individuals who decline testing in any care facility
				All HCWs performing AGMPs	No COVID-19 symptoms and no test results MEDIUM RISK PATHWAY	Contact and airborne precautions: • Face filtering piece (FFP3) or Hood respirator • Disposable gloves • Disposable gown • Eye/face protection (visor)	
				Patient	Suspected or confirmed COVID-19 MEDIUM RISK PATHWAY	Surgical facemask (Type II or Type IIR), if tolerated and does not compromise their clinical care, such as when receiving oxygen therapy	

Jurisdiction/ Source	Document type Reference Version Date	COVID-19 Community Transmission Scenario	Care Setting	Guidance for Who & Activity	Patient COVID-19 Status	Recommended PPE Requirements	Other Guideline Comments[4]
		Not reported	All healthcare settings	All HCWs providing direct patient care	Suspected or confirmed COVID-19 Referred to as HIGH RISK PATHWAY (see comments for description)	Contact and Droplet precautions: • FRSM Type IIR • Disposable gloves • Disposable apron or gown, gown required if risk of spraying / splashing • Eye/face protection (visor)	HIGH RISK PATHWAY: a) untriaged individuals present for assessment or treatment (symptoms unknown*) OR b) confirmed SARS-CoV-2 (COVID-19) positive patients are cared for OR c) symptomatic or suspected COVID-19 individuals including those with a history of contact with a COVID-19 case who have been triaged / clinically assessed and are waiting test results OR d) symptomatic individuals who decline testing
				All HCWs performing AGMPs	Suspected or confirmed COVID-19 HIGH RISK PATHWAY	Contact, droplet, and airborne precautions: • Face filtering piece (FFP3) or Hood respirator • Disposable gloves • Disposable gown • Eye/face protection (visor)	
				Patients	Suspected or confirmed COVID-19 HIGH RISK PATHWAY	Surgical facemask (Type II or Type IIR), if tolerated and does not compromise their clinical care, such as when receiving oxygen therapy	
United States Centers for Disease Control and Prevention	Guidance document “Interim Infection Prevention and Control Recommendations for Healthcare	None to all levels of community transmission	Anywhere in healthcare facility, including breakrooms or other spaces where they might	All HCWs in all activities outside of providing direct patient care	Any patient status	Facemasks (preferred over cloth face masks when available)	Considered as part of universal source control measures Cloth masks should NOT be worn instead of a respirator or facemask if more than source control is needed To reduce the number of times HCW must touch their face and potential risk for self-

Jurisdiction/ Source	Document type Reference Version Date	COVID-19 Community Transmission Scenario	Care Setting	Guidance for Who & Activity	Patient COVID-19 Status	Recommended PPE Requirements	Other Guideline Comments[4]
	Personnel During the Coronavirus Disease 2019 (COVID-19) Pandemic" https://www.cdc.gov/coronavirus/2019-ncov/hcp/infection-control.html November 4, 2020		encounter co-workers				contamination, HCW should consider continuing to wear the same respirator or facemask (extended use) throughout their entire work shift, instead of intermittently switching back to their cloth mask. HCW should remove their respirator or facemask, perform hand hygiene, and put on their cloth mask when leaving the facility at the end of their shift.
			Anywhere in healthcare facility	Patients and visitors upon arrival and throughout their stay in the healthcare facility Excluding young children under age 2, anyone who has trouble breathing, or anyone who is unconscious, incapacitated or otherwise unable to remove the mask without assistance	Any patient status	Cloth masks, if tolerated	Considered as part of universal source control measures Patients may remove their cloth mask when in their rooms but should put it back on when around others (e.g., when visitors enter their room) or leaving their room

Jurisdiction/ Source	Document type Reference Version Date	COVID-19 Community Transmission Scenario	Care Setting	Guidance for Who & Activity	Patient COVID-19 Status	Recommended PPE Requirements	Other Guideline Comments[4]
		No to low community transmission	All healthcare settings	All HCWs providing direct patient care	Suspected or confirmed COVID-19	Standard and Transmission-Based Precautions based on anticipated exposures and suspected or confirmed diagnoses, could include: • N95 or equivalent or higher-level respirator (or facemask if respirator not available) • Gown • Gloves • Eye protection	Respirator or Facemask • Cloth masks are NOT PPE and should not be worn for the care of patients with suspected or confirmed COVID-19 or other situations where use of a respirator or facemask is recommended • Put on an N95 respirator (or equivalent or higher-level respirator) or facemask (if a respirator is not available) before entry into the patient room or care area • Other respirators include other disposable filtering facepiece respirators, powered air purifying respirators (PAPRs), or elastomeric respirators. • Disposable respirators and facemasks should be removed and discarded after exiting the patient's room or care area and closing the door unless implementing extended use or reuse. Perform hand hygiene after removing the respirator or facemask • If reusable respirators (e.g., powered air-purifying respirators [PAPRs] or elastomeric respirators) are used, they should also be removed after exiting the patient's room or care area. They must be cleaned and disinfected according to manufacturer's reprocessing instructions prior to re-use. Gloves • Put on clean, non-sterile gloves upon entry into the patient room or care area.
				All HCWs performing AGMP	Suspected or confirmed COVID-19	Standard and Transmission-Based Precautions based on anticipated exposures and suspected or confirmed diagnoses, could include: • N95 or equivalent or higher-level respirator • Gown • Gloves • Eye protection	
		Moderate to substantial community transmission	All healthcare settings	All HCWs providing direct patient care	Suspected or confirmed COVID-19	Standard and Transmission-Based Precautions based on anticipated exposures and suspected or confirmed diagnoses, could include:	

Jurisdiction/ Source	Document type Reference Version Date	COVID-19 Community Transmission Scenario	Care Setting	Guidance for Who & Activity	Patient COVID-19 Status	Recommended PPE Requirements	Other Guideline Comments[4]
						• N95 or equivalent or higher-level respirator • Gown • Gloves • Eye protection	• Change gloves if they become torn or heavily contaminated. • Remove and discard gloves before leaving the patient room or care area, and immediately perform hand hygiene. Gowns • Put on a clean isolation gown upon entry into the patient room or area. • Change the gown if it becomes soiled. Remove and discard the gown in a dedicated container for waste or linen before leaving the patient room or care area. • Disposable gowns should be discarded after use. Reusable (i.e., washable or cloth) gowns should be laundered after each use. Eye Protection • Put on eye protection (i.e., goggles or a face shield that covers the front and sides of the face) upon entry to the patient room or care area, if not already wearing as part of extended use strategies to optimize PPE supply. • Protective eyewear (e.g., safety glasses, trauma glasses) with gaps between glasses and the face likely do not protect eyes from all splashes and sprays. • Ensure that eye protection is compatible with the respirator so there is not interference with proper positioning of the eye protection or with the fit or seal of the respirator.
				All HCWs performing AGMP	Suspected or confirmed COVID-19	Standard and Transmission-Based Precautions based on anticipated exposures and suspected or confirmed diagnoses, could include: • N95 or equivalent or higher-level respirator • Gown • Gloves • Eye protection	

Jurisdiction/ Source	Document type Reference Version Date	COVID-19 Community Transmission Scenario	Care Setting	Guidance for Who & Activity	Patient COVID-19 Status	Recommended PPE Requirements	Other Guideline Comments[4]
							• Remove eye protection after leaving the patient room or care area, unless implementing extended use. • Reusable eye protection (e.g., goggles) must be cleaned and disinfected according to manufacturer's reprocessing instructions prior to re-use. • Disposable eye protection should be discarded after use unless following protocols for extended use or reuse.
World-wide World Health Organization (WHO)	Guidance document "Rational use of personal protective equipment for coronavirus disease (COVID-19) and considerations during severe shortages" https://www.who.int/publications/i/item/rational-use-	Not reported	Inpatient and outpatient facilities	HCWs initially screening patients	Any patient status	No PPE required	Maintain physical distance of at least 1 metre. Ideally, build glass/plastic screens to create a barrier between health care workers and patients When physical distance is not feasible and yet no patient contact, use mask and eye protection.
				Patients while being initially screened	Without symptoms suggestive of COVID-19	No PPE required	Perform hand hygiene and have the patient perform hand hygiene

Jurisdiction/ Source	Document type Reference Version Date	COVID-19 Community Transmission Scenario	Care Setting	Guidance for Who & Activity	Patient COVID-19 Status	Recommended PPE Requirements	Other Guideline Comments[4]
	of-personal-protective-equipment-for-coronavirus-disease-(covid-19)-and-considerations-during-severe-shortages April 6, 2020				Symptoms suggestive of COVID-19	Provide medical mask if tolerated by patient.	Maintain physical distance of at least 1 metre. Immediately move the patient to an isolation room or separate area away from others; if this is not feasible, ensure spatial distance of at least 1 metre from other patients. Perform hand hygiene and have the patient perform hand hygiene
				All HCWs providing physical examination of patient	Without symptoms suggestive of COVID-19	• PPE according to standard precautions and risk assessment.	Perform hand hygiene PPE should be used in combination with administrative and engineering controls. The indications for PPE should be based on the setting, target audience, risk of exposure (e.g. type of activity) and the transmission dynamics of the pathogen (e.g. contact, droplet, or aerosol). The overuse or misuse of PPE will have a further impact on supply shortages.
				All HCWs providing direct care in patient room	COVID-19 positive	• Medical mask • Gown • Gloves • Eye protection (goggles or face shield)	
				All HCWs performing AGMPs	COVID-19 positive	• Respirator N95 or FFP2 or FFP3 standard, or equivalent. • Gown • Gloves • Eye protection • Apron	
World-wide WHO	Guidance document “Infection prevention and	Any community transmission	Any clinical areas	All HCWs during all routine activities throughout	Any patient status	Continuous medical masking	

Jurisdiction/ Source	Document type Reference Version Date	COVID-19 Community Transmission Scenario	Care Setting	Guidance for Who & Activity	Patient COVID-19 Status	Recommended PPE Requirements	Other Guideline Comments[4]
	control during health care when coronavirus disease (COVID-19) is suspected or confirmed" https://www.who.int/publications/i/item/WHO-2019-nCoV-IPC-2020.4 June 29, 2020			duration of shift			
			Intensive care unit, where AGMPs frequently performed	Intensive care HCWs throughout duration of shift	Any patient status	Continuous particulate respirator (US National Institute for Occupational Safety and Health (NIOSH)-certified N95, European Union (EU) standard FFP2, or equivalent)	

Table 5. Summary of Included Guidelines and Guidance Documents Concerning PPE requirements in Long-Term Care Facilities

Jurisdiction/ Source	Document type Reference Version Date	Guidance for Who & Activity	Patient COVID-19 Status	Recommended PPE Requirements	Other Guideline Comments[6]
CANADA					
British Columbia (BC) BC Centre for Disease Control (BC CDC)	Guidance document "Infection Prevention and Control Requirements for COVID-19 in Long Term Care and Seniors' Assisted Living" http://www.bccdc.ca/Health-Info-Site/Documents/COVID19_LongTermCareAssistedLiving.pdf June 30, 2020	All LTC workers throughout their shift	Any patient status	Surgical/procedure mask	Surgical/procedure masks should be changed if the masks become wet, damaged or visibly soiled. Surgical/procedure masks should be removed just prior to breaks or when leaving the facility. Change gloves in between clients, accompanied by hand hygiene between each glove change. Doff old PPE and don a new set when moving from clients with COVID-19 to those not diagnosed with COVID-19. Change surgical or procedure mask if the mask becomes wet, damaged, or soiled or when leaving the facility. Practice hand hygiene after removing each individual piece of PPE, and before putting on new PPE.
		All HCWs providing direct patient and entering in COVID-19 units or rooms on droplet and contact precautions	Suspected and/or co3nfirmed COVID-19 or have respiratory symptoms	Contact and droplet precautions: • Surgical/procedural mask • Eye protection (i.e., eye goggles or face shield) • Gloves • Gown	
		All HCWs performing Aerosol-Generating Medical Procedures (AGMPs) or airborne precautions sign is posted	Suspected and/or confirmed COVID-19	Airborne precautions: • Fit-tested N95 respirator • Eye protection (face shield, safety glasses or goggles) • Gown • Gloves	In LTC and AL settings, AGMPs on clients suspected or confirmed to have COVID-19 should only be performed when medically necessary to reduce the need for N95 respirators. If an AGMP is performed, ensure the fewest number of staff necessary to perform the procedure are present.

[6] Text extracted verbatim from the source document

Jurisdiction/ Source	Document type Reference Version Date	Guidance for Who & Activity	Patient COVID-19 Status	Recommended PPE Requirements	Other Guideline Comments[6]
British Columbia Vancouver Coastal Health	Guidance document "PPE Recommendations – COMMUNITY" http://ipac.vch.ca/Documents/COVID-19/Dress%20Codes%20and%20PPE/PPE_Recommendations_%28Community%29.pdf April 15, 2020	All HCWs providing direct care in patient room or shared spaces	Without symptoms and low-risk of COVID-19	• Procedure Mask • Eye Protection • Gloves	The same Mask and Eye Protection should be used between patient rooms and Common Clinical Spaces. Gloves should be changed between patients and doffed when leaving the patient care area
		All HCWs providing direct care in patient room	Suspected and/or confirmed COVID-19	Contact and droplet precautions: • Procedure mask • Eye protection (i.e., eye goggles or face shield) • Gloves • Gown	The same Mask and Eye Protection should be used between patient rooms and in the Shared and Common Clinical Spaces. Gowns and gloves should be doffed upon leaving patient care area
		All HCWs performing AGMPs	Suspected and/or confirmed COVID-19	Airborne + Droplet/Contact and droplet precautions: • N95 Respirator or equivalent (Re-usable or disposable) • Eye Protection • Gown • Gloves	The same Respirator and Eye Protection should be used between patient rooms and Common Clinical Spaces. Gowns and gloves should be doffed upon leaving patient room
Manitoba Shared Health	Guidance document "Provincial Requirements for Personal Protective Equipment (PPE)" https://sharedhealthmb.ca/files/covid-19-provincial-ppe-requirements.pdf	All HCWs providing direct resident care, includes care and support that requires close resident encounter (e.g. dietary, OT, PT)	COVID-19 Non-Suspect	• Procedure mask • Eye protection • Gloves as per routine practices • Gowns as per routine practices	Extended use of same mask for repeated interactions with multiple patients. Store and reuse same procedure mask following coffee break (s) unless caring for patient requiring additional precautions for respiratory viruses; change mask following meal break Change mask if it becomes wet, damaged, or soiled Eye protection to be used throughout the shift with appropriate cleaning and disinfecting protocols. Remove and clean/disinfect at breaks and at end of shift. Wherever possible, retain face

Jurisdiction/ Source	Document type Reference Version Date	Guidance for Who & Activity	Patient COVID-19 Status	Recommended PPE Requirements	Other Guideline Comments[6]
	July 14, 2020				shields, lenses and/or frames and disinfect eye protection at the end of the shift. Gowns are to be used as per routine practices (e.g. MRSA, Scabies, blood or body fluid contact or excessive soiling) AND in situations requiring additional precautions Gloves are not required for every patient interaction however meticulous attention to hand hygiene is required. Gloves should only be applied as per routine practices and additional precautions (e.g. MRSA, Scabies, blood or body fluid contact or excessive soiling)
			COVID-10 Positive or Suspect	• Procedure mask or N95 respirator if point of care risk assessment indicates use • Eye protection • Gloves as per routine practices • Gowns as per routine practices	Extended use of same mask, eye protection for repeated interactions with multiple patients; discard and replace mask following breaks. Change mask if it becomes wet, damaged, soiled and/or at breaks. With COVID-19 Positive and/or Suspect-patients if point of care risk assessment indicates use of N95, extend use of same N95 respirator, for repeated interactions with multiple patients. Change respirator if it becomes wet, damaged, soiled and/or at breaks and/or post intubation. Eye protection to be used throughout the shift with appropriate cleaning and disinfecting protocols. Remove and clean/disinfect at breaks and at end of shift. Wherever possible, retain face shields, lenses and/or frames and disinfect eye protection at the end of the shift. With COVID-19 Positive-patients, extend use of gowns except in situations when gowns should be used as per routine practices (e.g. MRSA, Scabies, blood or body fluid contact or excessive soiling) AND in situations requiring additional precautions. Remove gown prior to leaving the COVID-19 Positive unit.

Jurisdiction/ Source	Document type Reference Version Date	Guidance for Who & Activity	Patient COVID-19 Status	Recommended PPE Requirements	Other Guideline Comments[6]
					With COVID-19 Suspect-patients, gowns are to be used as per routine practices and additional precautions(e.g. MRSA, Scabies, blood or body fluid contact or excessive soiling). With COVID-19 Positive AND Suspect-patients, gloves must be applied and changed per Routine Practices and Additional Precautions (e.g. MRSA, scabies, blood or body fluid contact or excessive soiling). Hand Hygiene before/after donning/doffing gloves or contact with patient or patient environment without gloves
		All HCWs performing AGMPs	COVID-19 Non-Suspect	• Procedure mask • Eye protection • Gloves • Gown	N95 respirators are not required for AGMPs, unless: • There is clinical concern of infection with an airborne pathogen such as Mycobacterium tuberculosis; OR • The patient is demonstrating new onset of respiratory symptoms of an infectious nature and is being assessed for COVID-19 testing and as a result, their status is being changed to COVID-19 suspect Extended use of N95 for repeated interactions with multiple patients (excluding post intubation)
			COVID-19 Positive or Suspect	• N95 respirator • Eye protection • Gloves • Gown	Extend N95 respirator (COVID-19 Positive and/orCOVID-19 Suspect-patients), eye protection for repeated interactions with multiple patients Change respirator if it becomes wet, damaged, soiled and/or at breaks and/or post intubation.
		Patients	Without respiratory symptoms	PPE not required	Reinforce Hand Hygiene

Jurisdiction/ Source	Document type Reference Version Date	Guidance for Who & Activity	Patient COVID-19 Status	Recommended PPE Requirements	Other Guideline Comments[6]
			With respiratory symptoms	If patient is not wearing their own or homemade mask, provide mask	
		Patients	Without respiratory symptoms	PPE not required	Reinforce Hand Hygiene
			With respiratory symptoms	PPE not required	Reinforce Hand Hygiene
		Patients	Without respiratory symptoms	PPE not required	Reinforce Hand Hygiene
			With respiratory symptoms	Procedure mask, if no artificial airway and if tolerated N100 filter, if an artificial airway	
Ontario Public Health Ontario	Technical Brief "IPAC Recommendations for Use of Personal Protective Equipment for Care of Individuals with Suspect or Confirmed COVID-19" https://www.publichealthontario.ca/-	All LTC staff	Any patient status	Surgical or procedural mask	This guidance is intended to inform minimum expectations for PPE; however, HCWs should refer to and follow their own institutional or organizational infection prevention and control policies and procedures on PPE, as well as consider their local epidemiology to help inform their decision of a suspect case. HCWs should perform a PCRA for patient encounters. **For every patient and/or patient environment encounter, apply the Four Moments for Hand Hygiene** (https://www.publichealthontario.ca/-/media/documents/B/2014/bp-hand-hygiene.pdf?la=en). * Universal masking for source control (i.e. to protect others from the mask wearer) is a current practice for HCWs in Ontario.

Jurisdiction/ Source	Document type Reference Version Date	Guidance for Who & Activity	Patient COVID-19 Status	Recommended PPE Requirements	Other Guideline Comments[6]
	/media/documents/ncov/updated-ipac-measures-covid-19.pdf?la=en July 27, 2020	All HCW providing	Confirmed or suspected COVID-19	Droplet and Contact Precautions, including: • Surgical/procedure mask • Isolation gown • Gloves • Eye protection (goggles or face shield)	
		All HCW performing CPAP and/or open suctioning	Confirmed or suspected COVID-19	Droplet and Contact Precautions, including: • Surgical/procedure mask or N95 respirator for CPAP • Isolation gown • Gloves • Eye protection (goggles or face shield)	Manage in single room with door closed. Keep the number of people in the room during the procedure to a minimum.
Saskatchewan Saskatchewan Health Authority	PPE Guidelines "CONTINUOUS and EXTENDED USE PPE GUIDELINES when caring for Patients suspected or confirmed to have COVID-19 in Continuing Care" https://www.saskhealthauthority.ca/news/service-alerts-emergency-events/covid-19/PPE-infection-prevention-control/Documents/Personal%20Protective%	All LTC staff	Any patient status	Surgical or procedural mask	
		Direct Care Staff (RNs, LPNs, CCAs Physicians, etc.) providing direct care in resident rooms And Other Allied Health Staff (Therapists, Lab, Social Work, Maintenance, etc.)	Suspected or confirmed COVID-19	• Face Mask • Eye Protection • Gown • Gloves	Mask: Change IF it becomes wet, soiled, or damaged. Discard when taking a scheduled break and at end of shift Eye Protection: Remove/disinfect before a scheduled break and at the end of shift. Discard face shield at the end of shift Gown and gloves: Change between each patient encounter Perform hand hygiene according to SHA Hand Hygiene Policy For allied health staff: Do not enter IF Droplet/Contact Plus AND Airborne Precaution Signage or Aerosolize Settle Time sign is posted and you are not fit-tested

Jurisdiction/ Source	Document type Reference Version Date	Guidance for Who & Activity	Patient COVID-19 Status	Recommended PPE Requirements	Other Guideline Comments[6]
	20Equipment/Recommendations/CV-19-G0007-Continuous-and-Extended-PPE-Use-Guidelines-Continuing-Care.pdf July 7, 2020	Direct Care Staff providing direct care in resident rooms performing AGMPs	Suspected or confirmed COVID-19	• N95 respirator (fit-tested, seal checked) • Eye Protection • Gown • Gloves	N95 respirator: Extend use for multiple AGMPs. Change N95 respirator IF it becomes wet, damaged, or soiled. Discard when taking a scheduled break and at end of shift N95 respirator: Extend use for single AGMP. Change N95 respirator IF it becomes wet, damaged, or soiled. Discard when taking a scheduled break and return to continuous mask use guidelines Eye Protection: Remove/disinfect before a scheduled break and at the end of shift. Discard face shield at the end of shift Gown and gloves: Change between each patient encounter Perform hand hygiene according to SHA Hand Hygiene Policy
Canada-wide Public Health Agency of Canada (PHAC)	Guidance document "Infection prevention and control for COVID-19: Interim guidance for long term care homes" https://www.canada.ca/en/public-health/services/diseases/2019-novel-coronavirus-infection/prevent-control-covid-19-long-term-care-homes.html May 12, 2020	All HCWs throughout the duration of their shift	Any patient status	Mask	Staff and essential visitors will perform hand hygiene before they put on a mask when they enter the LTCH, before and after removal, and prior to putting on a new mask Staff and essential visitors will wear a mask securely over their mouth and nose and adjust the nose piece to fit snugly while mask is worn Staff and essential visitors should not touch the front of mask while wearing it. Staff and essential visitors should not dangle the mask under their chin, off the ear, under the nose or place on top of head Masks should be removed just prior to breaks or when leaving the building, while in an area where no residents, staff or visitors are present, and discarded in the nearest no-touch waste receptacle Generally it is a foundational concept in IPC practice, that masks should not be re-worn. However, in the context of the COVID-19

Jurisdiction/ Source	Document type Reference Version Date	Guidance for Who & Activity	Patient COVID-19 Status	Recommended PPE Requirements	Other Guideline Comments[6]
					pandemic and PPE shortages please follow jurisdictional guidance with regard to mask use, reuse, and reprocessing
		All HCWs providing direct patient care	Patients presenting with a fever and/or a new or worsening cough or acute respiratory illness	Droplet and contact precautions: • Gloves • Long-sleeved cuffed gown (covering front of body from neck to mid-thigh) • Mask (which should already be worn due to mask during all shifts) • Face or eye protection	Examples of face or eye protection (in addition to mask) include full face shield, mask with attached visor, non-vented safety glasses or goggles (regular eyeglasses are not sufficient) PPE (except mask when mask during all shifts is practiced) should be removed in the correct order and discarded prior to exiting the resident's room or ante-room in the nearest no-touch waste receptable The area where PPE is put on should be separated as much as possible from the area where it is removed and Discarded Hand hygiene should occur according to best practices for putting on or removing PPE
		All HCWs in the room during AGMPs	Suspected or confirmed COVID-19	Droplet and contact precautions: • Gloves • Long-sleeved cuffed gown (covering front of body from neck to mid-thigh) • Mask (see comments regarding N95 use) • Face or eye protection	Follow provincial or territorial guidance for other procedures that require the use of an N95 respirator. This guidance may vary among provinces and territories. AGMPs on a resident suspected or confirmed to have COVID-19 should only be performed if: • The AGMP is medically necessary and performed by the most experienced person • The minimum number of persons required to safely perform the procedure are present • All persons in the room are wearing a fit-tested, seal-checked N95 respirator, gloves, gown and face or eye protection • The door of the room is closed • Entry into a room of a patient undergoing CPAP is minimized

Jurisdiction/ Source	Document type Reference Version Date	Guidance for Who & Activity	Patient COVID-19 Status	Recommended PPE Requirements	Other Guideline Comments[6]
INTERNATIONAL					
Australia Government of Australia	Guidance document "Infection Control Expert Group COVID-19 Infection Prevention and Control for Residential Care Facilities" https://www.health.gov.au/resources/publications/coronavirus-covid-19-guidelines-for-infection-prevention-and-control-in-residential-care-facilities November 18, 2020	All staff of residential care facility and if exposure to body fluids or heavily contaminated surfaces is expected	Suspected or confirmed COVID-19	Standard precautions: • Gowns • Surgical mask • Eye protection • Gloves	PPE is part of standard IPC practices: Hand hygiene before and after each resident contact and after contact with potentially contaminated surfaces or objects (even when hands appear clean). Gloves are not a substitute for hand hygiene. Staff should perform hand hygiene before putting gloves on and after taking them off. Cough etiquette and respiratory hygiene Regular cleaning of the environment and equipment. Provision of alcohol-based hand sanitiser at the entrance to the facility and other locations.
		HCWs and staff during the clinical consultation and physical examination Or in contact with ill residents or residents in quarantine	Suspected or confirmed COVID-19	Contact and droplet precautions: • Gown • Surgical mask • Protective eyewear (safety glasses, eye shield, face shield, or goggles) • Gloves	
		All HCWs performing AGMPs or providing routine care to patients with cognitive impairment, are unable to cooperate or exhibiting challenging behaviours or	Suspected or confirmed COVID-19	Contact and airborne precautions: • Gowns/Aprons • Particle filter respirator (PFR), such as a P2 or N95 respirator • Eye protection • Gloves • Boot/shoe covers • Head covers	

Jurisdiction/ Source	Document type Reference Version Date	Guidance for Who & Activity	Patient COVID-19 Status	Recommended PPE Requirements	Other Guideline Comments[6]
		there are high numbers of suspected, probable or confirmed COVID-19 residents			
Australia Government of Australia	Guidance document "Recommended minimum requirements for the use of masks or respirators by health and residential care workers in areas with significant community transmission of COVID-19" https://www.health.gov.au/resources/publications/iceg-guidance-masks-respirators-health-residential-care-workers October 23, 2020 ***Similar PPE guidance for continuous HCW masking in long-term care facilities as for those in acute care settings – see description in Table X.***				
New Zealand New Zealand Ministry of Health	Guidance document "Personal protective equipment use in aged residential care settings" https://www.hqsc.govt.nz/assets/ARC/PR/COVID-19/PPE-guidance-for-ARC-31-Mar-2020.pdf March 31, 2020	All HCWs providing routine patient care	Probable or confirmed COVID-19	Contact and droplet precautions (in addition to standard precautions): • Medical mask • Eye protection (goggles or face shield) • Fluid-resistant long sleeve gown • Plastic apron • Gloves	Strategies to preserve or optimise PPE to prolong the supply if an ARC facility is experiencing temporary shortage: • Clean reusable eye protection (goggles or face shield) between use • Surgical masks may remain on until if feels damp or up to four hours. Do not touch your face/eyes whilst you are wearing your mask. Remove and dispose of safely as demonstrated in the poster and video below. • Remember to wash hands after removal and between each interaction with people you are caring for
		All HCWs performing AGMPs Or if respiratory protection programme is implemented in the facility	Probable or confirmed COVID-19	Contact and Airborne Precautions: • N95 or P2 mask • Eye protection (goggles or face 3shield) • Fluid-resistant long sleeve gown • Plastic apron • Gloves	

Jurisdiction/ Source	Document type Reference Version Date	Guidance for Who & Activity	Patient COVID-19 Status	Recommended PPE Requirements	Other Guideline Comments[6]
European Union Countries and the United Kingdom European Centre for Disease Control	Technical Report "Guidance for wearing and removing personal protective equipment in healthcare settings for the care of patients with suspected or confirmed COVID-19" https://www.ecdc.europa.eu/en/publications-data/guidance-wearing-and-removing-personal-protective-equipment-healthcare-settings February 2020 ***Similar PPE guidance for HCWs in long-term care facilities as for those in acute care settings – see description in Table X.***				
United Kingdom Department of Health and Social Care (DHSC), Public Health Wales (PHW), Public Health Agency (PHA) Northern Ireland, Health Protection Scotland (HPS)/National Services Scotland, Public Health England (PHE) and	Official guidance "COVID-19: Guidance for the remobilisation of services within health and care settings Infection prevention and control recommendations" https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/910885/COVID-19_Infection_prevention_and_control_guidance_FINAL_PDF_20082020.pdf August 20, 2020 ***Similar PPE guidance for HCWs in long-term care facilities as for those in acute care settings – see description in Table X.***				

Jurisdiction/ Source	Document type Reference Version Date	Guidance for Who & Activity	Patient COVID-19 Status	Recommended PPE Requirements	Other Guideline Comments[6]
NHS England					
United States Centers for Disease Control and Prevention	Guidance document "Interim Infection Prevention and Control Recommendations for Healthcare Personnel During the Coronavirus Disease 2019 (COVID-19) Pandemic" https://www.cdc.gov/coronavirus/2019-ncov/hcp/infection-control.html November 4, 2020 ***Similar guidance for HCWs in long-term care facilities as for those in acute care settings – see description in Table X.***				
World-wide World Health Organization (WHO)	Guidance document "Infection Prevention and Control guidance for Long-Term Care Facilities in the context of COVID-19" https://apps.who.int/iris/handle/10665/331508 March 21, 2020	Residents	Suspected or confirmed COVID-19	Medical mask	
		All HCWs providing routine resident care	Suspected or confirmed COVID-19	Contact and droplet precautions: • Medical mask • Gloves • Gown • Eye protection (goggles or face shield).	PPE should be put on and removed carefully following recommended procedures to avoid contamination. Hand hygiene should always be performed before putting on and after removing PPE Employees should take off PPE just before leaving a resident's room. Discard PPE in medical waste bin and preform hand hygiene.
		All HCWs performing AGMPs	COVID-19 positive	Contact and airborne precautions: • Respirator N95 or FFP2 or FFP3 respirators, equivalent mask • Gown • Gloves • Eye protection (goggles or face shield)	Use N95 mask only if the LTCFs has a programme to regularly fit-test employees for the use of N95 masks

Table 6. Characteristics of Systematic Reviews

Primary author, year, country	Databases and search date Grey Lit search Search limits	Number and design of studies included	Interventions	Outcomes
Verbeek et al. 2020, Cochrane Collaboration, UK	CENTRAL, MEDLINE, Embase, CINAHL Up to 20 March 2020 Earlier versions published in 2016 and 2019	Controlled studies 24 studies, 2278 participants 14 RCTs, 1 quasi-RCT, 9 non-randomised design	Type of full-body PPE, Modified PPE, methods of donning/doffing PPE, training	Infection Contamination Noncompliance
Jefferson et al. 2020 Cochrane Collaboration, UK	CENTRAL, PubMed, Embase, CINAHL, up to 1 April 2020 ClinicalTrials.gov, WHO ICTRP on 16 March 2020 Earlier versions published in 2007, 2009, 2010, 2011. Does not include studies from current COVID-19 pandemic	RCTs and cluster-RCTs (previous versions included observational studies, but sufficient RCTs to address study aims) 44 new RCTs and cluster-RCTs for a total of 67 randomized trials 6 ongoing studies	Physical interventions (screening at entry ports, isolation, quarantine, physical distancing, personal protection, hand hygiene, face masks, gargling)	Respiratory virus transmission
MacIntyre 2020, Australia	Medline, Embase Up to 17 April 2020	Randomized controlled trials	Masks vs respirators by community, HCWs and sick patients (source control)	Infection
Ramaraj et al. 2020, UK	PubMed/Medline, Google Scholar, Grey literature- references of guidelines from UK, USA and EU/EEA, snowball search Rapid review	Any design with primary data; pre-prints/unpublished articles online Laboratory and clinical studies	Fluid repellent surgical mask vs respirator	SARS-CoV-2 protection (protection factor, clinical outcomes)

	Up to 30 April 2020			
Santos et al. 2020 Brazil	PubMed, Scopus, Web of Science, Cochrane, VHS, OpenGrey, Google Scholar and Clinical Trials Up to 30 April 2020 No language restrictions	Randomized or non-randomized clinical trials, observational and laboratory studies 9 lab studies 1 non-randomized clinical trial 1 randomized clinical trial + laboratory data	Homemade and/or commercial cloth masks vs. surgical mask and/or N95 respirator	Filtration efficiency (%), penetration level (%), airflow resistance, protection factor, cough experiment, pressure drop, surface masks test, occupational health (clinical respiratory illness, ILI, lab-confirmed respiratory virus infection), pressure differential
Bartosczo 2020, Canada	MedLine, Embase, CENTRAL January 1, 2014 – March 9, 2020 HCWs only	Randomized controlled trials, cluster-RCTs,	Medical masks vs N95/FFP2	Viral respiratory infection – lab confirmed, lab confirmed coronavirus infection, lab confirmed influenza, ILI, clinical respiratory illness, workplace absenteeism
Licina et al. 2020 Australia	Medline, Embase, Cochrane Library, CENTRAL, Google Scholar, OpenGrey, GreyNet Up to June 2020 HCWs only in inpatient care/critical care/intensive care	Randomized controlled trials, non-randomized controlled trials, observational studies, simulation studies 10 articles	PAPR separately or within PPE vs. any other respiratory protective equipment (FFP3/FFP2/N95, or surgical masks)	HCW infection rates (SARS-CoV-2, SARS-CoV-1, Ebola, MERS), contamination of skin or clothing, compliance with guidance, wearer comfort, measures of work of breathing, costs of resource use, training programs
Violante 2020, Italy	PubMed Excluded laboratory studies, no language limits Up to July 12, 2020	Review of systematic reviews published with literature to March 21, 2020	Surgical masks vs filtering facepiece respirators	Droplets/airborne infections
Ionnone 2020, Italty	PubMed, Embase, Cochran library Up to March 21, 2020	Randomized controlled trials, cluster-RCTs, 4 RCTs in meta-analysis, 5 RCTs total	N95 vs surgical masks	SARS-CoV-2 infection, Clinical respiratory illness, ILI, lab-confirmed respiratory viral infection, lab confirmed bacterial colonization, lab confirmed respiratory infection, lab-confirmed influenza, discomfort wearing respiratory protection

Samaranayake 2020	PubMed, Medline, Cochrane Library, Embase 1 Jan 1990 – 15 May 2020 HCWs, any healthcare setting	RCT, lab-controlled simulated models, case-control, cross-sectional studies 21 studies	Surgical facemasks vs N95 respirators Protective eyewear (goggles, face shield, visor)	Airborne transmission of respiratory pathogens Mask-fit and wearing time on protective barrier efficiency
Liang 2020, China	PubMed, Web of Science, Cochrane Library, Chinese National Knowledge Infrastructure, VIP (Chinese) database Up to March 2020	RCTs, observational studies (cohorts, case-control) 21 studies	Facemasks vs control	Diagnosis of respiratory virus, or local clinical diagnostic criteria are applied during acute large-scale infectious disease when lab evidence not available.
Zhang 2020, China	PubMed 1 Jan 2020 to 7 July 2020 HCWs (especially oral-maxillofacial surgery)	RCTs, observations studies (cohorts, case-control) 8 studies	N95 vs surgical masks	Laboratory-confirmed respiratory infection, ILI
Chou 2020, US	PubMed, Medline, Embase, WHO Database on Coronavirus Disease, medRxiv 2003 to 27 March 2020 Living review – last update 20 Oct 2020 HCWs	Cohort studies, case-series	Various risk factors, including infection prevention and control	SARS-CoV-2, SARS-CoV-1, MERS-CoV
Chu 2020, Canada	Medline, PubMed, Embase, CINAHL, Cochrane Lbirar, COVID-19 open research dataset challenge, COVID-19 research database (WHO), Epistemonikos, EPPI Centre, ClinicalTrials.gov, WHO International Clinical Trials Registry platform, pre-print servers 3 May 2020 Rapid systematic review No language restrictions	Any study design, any setting with confirmed/probable COVID-19, SARS or MERS and people in close contact with them	Distances between people and COVID-19 infected patients (≥1m vs <1m), +/- face mask on patient, +/_ face mask, eye protection or both on exposed individual	Infection with COVID-19, SARS or MERS

Table 7. Evidence extraction table of included studies for research question 4.

Reference	Study type	Population	Intervention (PPE, isolation, masking, etc.)	Findings	Notes
Abad, Fearday & Safdar, 2010	Systematic review	Hospitalized patients (n= 40 included studies)	Isolation precautions for any type of infection	- Among the studies that focused on the psychological impact of isolation, the majority showed a negative impact on patient psychology and behaviour, including higher scores for depression and anxiety, higher anger–hostility scores, and reports of fear and loneliness. - Evidence regarding the amount of care provided to patients in isolation is mixed – three studies found that patients in isolation receive less care (fewer examinations, fewer patient encounters, less likely to enter patient rooms); three studies found no difference in the care provided to patients on isolation precautions	- Quality of care findings may have limited generalizability to pandemic isolation units
Arasli et al., 2020	Critical content analysis of social media	Nurses	"PPE"	- The perceived absence of PPE was a factor in nurses' distress and worries regarding working during pandemics - PPE linked to theme of "Exhaustion" - skin reactions from the gloves, gowns, or face shields that were also worn by nurses for long hours during the existing pandemic discouraged nurses from using them - The excessive utilization of PPE will have an extra effect on stock deficiencies.	
Atay & Cura, 2020	Cross-sectional survey	Nurses in Turkey (n=307)	"PPE" - N95 masks (66.3% of nurses), surgical masks (77.8% of nurses), gloves (85.3% of nurses), goggles or face shields (70.0% of nurses), and overalls/gowns (74.8% of nurses) were most frequently worn for more than 4 hours	- Compared to shorter (4 hours or less) wear time, wearing an N95 mask continuously for more than 4 hours significantly increased the odds of developing redness of the cheeks (OR 1.6 times; 95% [CI], 1.03-2.18; $P < .05$) dryness of the mouth (OR 2.18; 95% CI, 1.39-3.46; $P < .05$), redness of the bridge of the nose (OR 2.02, 95% CI, 1.36-3.04; $P < .05$), and redness of ear flaps (OR 3.44; 95% CI, 1.14-0.34; $P < .05$)	

Reference	Study type	Population	Intervention (PPE, isolation, masking, etc.)	Findings	Notes
				- The odds of developing dry mouth were significantly higher when wearing a surgical mask for more than 4 hours (OR 1.47 times; 95% CI, 1.01-2.13; *P* < .05). - Compared to shorter wear times, wearing gloves for more than 4 hours increased the odds of dry hands (OR 2.39; 95% CI, 1.05-5.47; *P* < .05), sweating (OR 3.03; 95% CI, 1.26-3.37; *P* < .05), and redness (OR 1.52; 95% CI, 1.02-2.16; *P* < .05) - odds of reporting a headache were significantly higher when goggles or a face shield were worn for > 4 hours (OR 1.51; 95% CI, 0.99-2.14; *P* < .05) - odds of sweating when wearing overalls or a gown (OR 2.02; 95% CI, 1.41-3.83; *P* < .05)	
Bandaru et al., 2020	Non-clinical study	Healthcare workers in India (n=20)	N95 mask and face shield	- There was a statistically significant increase in speech reception threshold and a decrease in speech discrimination scores with the use of PPE; the *p*-values obtained for both parameters were less than 0.0001 on paired *t*-test. - There were no statistically significant differences in the changes in speech reception threshold and speech discrimination score values obtained with and without using PPE when comparing between different age groups (20–40 years *vs* 41–60 years), sex, and occupation	- Changes in speech perception may have implications for communication
Berry et al., 2020	Systematic review	Adult medical/surgical ward patients (n= 6 included studies)	Isolation precautions	- No significant difference in in-hospital cardiac arrest between isolated and non-isolated patients (low certainty) - No significant difference in ICU admissions between isolated and non-isolated patients (low certainty) - No significant difference in pressure injuries (low certainty) - Inconclusive evidence of an increase in falls injury in isolated patients compared to non-isolated patients (low certainty) - No significant difference in venous thromboembolism (low certainty)	

Reference	Study type	Population	Intervention (PPE, isolation, masking, etc.)	Findings	Notes
				- Balance of evidence suggests no significant difference in medication-related adverse events (very low certainty) - No difference in delirium (very low certainty) - Evidence is mixed for both inpatient death and hospital length of stay	
Bothra et al., 2020	Preliminary report	Healthcare workers and members of the public in India (n= 14)	Ear-loop style face masks	All 14 diagnosed with retroauricular dermatitis due to ear loops on face masks - N95 masks were the most commonly used mask in 35.7% of patients, having thermoelastic polymer straps. Sweat dermatitis was observed due to associated headgear use or using nylon cloth masks. - Latex was the commonest strap material resulting in dermatoses in 4(28.5%) patients - Friction caused by the strap, trapping of sweat, use of disinfectant to reuse masks, application of dyes to colour homemade masks are frequent causes of dermatitis using ear loop face masks	Unclear generalizability to Alberta due to mask styles in use in AHS
Carbon, 2020	Non-clinical experimental study	Volunteers (n= 36)	Surgical mask	- Presenting a mask on faces showed a clear performance drop in reading emotions in faces. With the exception of fearful and neutral faces, for which ceiling performance effects were observed, all emotional states were harder to read in faces with masks. - reading the emotional status of elderly faces was more difficult than reading it from middle-aged or young faces; this effect was pronounced when faces were shown with masks - for *face sex*, in contrast, we only found an effect for the accuracy of emotion reading. - Confidence in assessing emotions was decreased when viewing faces with masks - All emotional states with the exception of *fearful* were repeatedly confused with a neutral state. - *Sad* was often confused with *disgusted* and *neutral*, and *angry* was confused with *disgusted*, *neutral*, and *sad*.	Experimental study; decrease in emotional assessment may affect clinical care and patient perception of care

Reference	Study type	Population	Intervention (PPE, isolation, masking, etc.)	Findings	Notes
				- Most drastically was the misinterpretation of *disgusted* as *angry*, which showed up in nearly 38% of the cases, although such a confusion did only happen in 2% of the cases where no face mask was used.	
Catalano et al., 2003	Case-control observational study	Patients admitted to infectious disease units; isolation (n= 27), control (n= 24)	Isolation for antibiotic resistant infection; control patients were not isolated	- Depression (HAM-D): The control group's score decreased from 8.46 to 6.00 after 1 week of hospitalization, and the isolation group's score increased from 8.42 to 10.73. The ANCOVA showed this time-by-group interaction to be significant ($P < 0.001$) - Anxiety (HAM-A): The control group's score decreased from 8.37 to 4.71 after 1 week of hospitalization, and the isolation group's score increased from 8.00 to 11.11. The ANCOVA showed this time-by-group interaction to be significant ($P < 0.001$)	- Findings may not be generalizable due to small sample size and short time frame
Chou et al., 2020	Living systematic review	HCWs and persons in the community (n= 39 included studies)	Interventions were disposable N95 filtering facepiece respirators, surgical masks, and cloth masks	- Reporting of harms in the RCTs was suboptimal but did not indicate serious harms with mask use - the most common adverse events were discomfort, breathing difficulties, and skin events. - Evidence is mixed regarding the risk of adverse events for N95 or surgical mask	- No additional studies identified in updates
Ciris Yildiz, Ulasli Kaban & Tanriverdi, 2020	Descriptive study (survey)	Healthcare workers in Turkey (n= 553)	"Personal protective equipment" (non-specific)	- A total of 124 participants reported that the frequency of mask use decreases due to its discomfort, while 209 participants indicated that they do not prefer to use protective glasses due to its discomfort. - there was a significant positive correlation between the number of physical complaints and the subscale scores of participants' attitudes related to personal protective equipment ($r = 0.21$, $p = 0.001$ for comfort and difficulty subscale, and $r = -0.13$, $p = 0.001$ for accessibility). - 70.2% of them reported that using protective glasses cause difficulty in using their daily eyewear	- High risk of sampling bias

Reference	Study type	Population	Intervention (PPE, isolation, masking, etc.)	Findings	Notes
				- Pain in the face, redness, sores (around the eyes, ears, and nose) and dryness on the throat due to dehydration were the other most frequently reported physical complaints related to the use of personal protective equipment in healthcare professionals (mostly associated with N95 masks)	
Cohen et al., 2008	Prospective cohort study	Children admitted to private rooms in pediatric service in Toronto (n= 24 isolated, 41 nonisolated)	Isolation precautions	- Five patients were isolated with droplet precautions, 5 with contact precautions, and 1 with airborne precautions. Eleven isolated patients were placed under a combination of contact and droplet precautions, and 2 patients were isolated for a combination of contact, droplet, and airborne precautions - The quantity of care was similar in both groups in terms of time spent in the room, organ systems examined, vital signs recorded, GRASP scores, and RIW. The groups differed in the length of stay, which was 4.5 days for isolated patients versus 2.0 days for non-isolated patients (P .014). - There was no difference between the 2 groups in the average rating per item on the PFSQ (P .209) or in the number of safety or incident reports completed (P .109) - No significant difference in terms of time spent in the room by the attending physician or number of organ systems examined in isolated compared with non-isolated patients.	- Findngs may not apply to adult care or pandemic setting
Corley, Hammond & Fraser, 2009	Phenomenological study	Australian nurses during H1N1 pandemic influenza (n= 34)	n/a - Experiences with PPE	- A perceived lack of firm recommendations and guidelines regarding specifically what PPE was required created an element of confusion amongst the staff caring for these patients. Staff described feeling unsure regarding what PPE was required. - As guidelines changed, there was perception that the supplies of PPE were running low within the unit and this created an environment which made staff question whether they would remain adequately protected	- Small sample from Australia – may have limited generalizability to Alberta

Reference	Study type	Population	Intervention (PPE, isolation, masking, etc.)	Findings	Notes
				- One bedside nursing staff member stated ‘‘*as supplies ran out the ‘rules’ changed and surgical masks and plastic aprons were [considered] effective. It made me worried that the only reason it was changed was due to stock shortage and that perhaps we weren’t as protected”.* - *“our biggest fear was running out of things, like your masks and gowns...I think there was a time when they thought we were going to run out and resort to substandard masks*” - Generally, the wearing of PPE was tolerated by most staff as it was deemed a necessary measure in providing protection to them – “using PPE was really good”. However, the physical discomfort of PPE was a key theme – ‘‘*It was hard working in a gown and mask (very hot) and not being able to go out for a drink whenever as the unit was very busy. I found I was dehydrated with a headache at the end of all my shifts” and “very uncomfortable and very injurious...I had skin peeled off here [points to nares]”* - The application and removal of PPE was considered to be extremely time consuming for staff, particularly when requiring supplies or performing duties outside the isolated unit - Communication was challenging with PPE - Another issue of concern to many of the respondents was the amount of waste generated by the disposal of PPE and the extra workload and stress that this put on the wardspersons who are responsible for the cleaning and the removal of waste from the unit	
Daugherty et al., 2009	Cross-sectional survey	ICU Healthcare workers in USA during Influenza season (n= 292)	“PPE”	- Respondents who believed that adherence posed an inconvenience to their work routine were less likely to report high levels of adherence (odds ratio 0.42, 95% confidence interval 0.22– 0.80) - Belief that PPE interferes with quality of care was not associated with reduced adherence	

Reference	Study type	Population	Intervention (PPE, isolation, masking, etc.)	Findings	Notes
Day et al., 2012	Retrospective cohort study	Nonpyschiatric adult patients admitted to a tertiary care center from 2007 through 2009 (n= 60151)	Contact precautions (Isolation + full PPE)	- Fifteen percent of admissions were under contact precautions (9,684/60,151). Of these 9,684 patients, 42% were placed under contact precautions after admission (4,032/9,684), and 58% (5,652/9,684) were placed under contact precautions at admission - Patients moved to contact precautions during their stay were older (54.4 vs 50.8 years; *P* < .01), had longer lengths of stay in the hospital (median, 11.7 vs 5.1 days; *P* < .01), were more likely to transfer to an ICU (42.6% vs 16.2%; *P* < .01), and were more likely to die during their stay (10.0% vs 4.2%; *P* < .01) than patients who were placed under contact precautions at admission. - The prevalence of delirium in patients under contact precautions was 16.1% (1,562/9,684), compared with 7.6% (3,785/50,467) in patients not under contact precautions. - Contact precautions were significantly associated with delirium (OR, 1.40 [95% CI, 1.24–1.51]) - Patients placed under contact precautions after being newly identified as colonized or infected with an MDR bacterium were 1.75 times more likely to experience delirium than patients not under contact precautions (OR, 1.75 [95% CI, 1.60–1.92]; *P* < .01).	- Unclear effect of PPE on delirium
Farronato et al., 2020	Scoping review and cross-sectional survey	Italian dental professionals (n= 256); five included studies	FFP2 (N95) respirators	- Headaches as one of the main outcomes related to FFP2 wear, but not correlated to the hours spent wearing a respirator. Pressure and traction from mask straps are likely to be concurrent in the pathogenesis of those headaches, along with hypercapnia, hypoxemia, and stress from the current pandemic situation and its consequent workload. - Another significant side effect and relevant outcome in our survey was breathing difficulties, at least moderate for 63.5% of our sample, but not correlated with the hours spent wearing N95/FFP2 respirators. - The presence of concentration problems, exertion, breathing difficulties, and headaches resulted in a	

Reference	Study type	Population	Intervention (PPE, isolation, masking, etc.)	Findings	Notes
				moderate impaired working ability for 85.5% of our sample. Impaired working ability was strongly correlated to headaches (ρ = 0.212, $p < 0.01$), breathing difficulties (ρ = 0.566, $p < 0.01$), concentration problems (ρ = 0.748, $p < 0.01$), and exertion (ρ = 0.620, $p < 0.01$).	
Foo et al., 2006	Cross-sectional survey	Healthcare workers in the designated SARS hospital in Singapore (n= 340)	- N95 masks for an average duration of 8 hr a day and over a mean period of 8.4 months. - Rubber gloves for an average duration of 6.2 hr over a mean period of 9.4 months - gowns used were of the disposable variety and were worn for an average duration of 6.2 hr over a mean period of 8.8 months.	- No skin reactions associated with surgical or paper masks - 109 (35.5%) of the 307 staff who used masks regularly reported adverse skin reactions, which included acne (59.6%), facial itch (51.4%), and rash (35.8%) - 64 (21.4%) of the 299 staff who used gloves regularly reported adverse skin reactions, which included dry skin (73.4%), itch (56.3%), rash (37.5%), and wheals (6.3%) - 4 (1.6%) of the 258 staff who wore gowns regularly reported adverse skin reactions	- Potential recall and response bias - Unclear if findings are generalizable to Alberta
Galehdar et al., 2020	Qualitative study	Nurses in Iran (n = 20)	n/a - sources of psychological stress	- Wearing protective clothes is an unpleasant feeling which has to be experienced by the nurses during each shift - Wearing protective clothes, restrictions in mobility, eating, and drinking, as well as being unknown to others can affect nurses' mood and lead to extreme fatigue - Nurses' identity is concealed by wearing protective equipment, which impairs the understanding of the body image and self-esteem - Inability to relieve discomfort affects mood - Inability to share identity with patients while wearing PPE	- Unclear if generalizable to Alberta
Gasink et al., 2008	Cross-sectional survey	Patients in general medical and surgical wards in Pennsylvania (n= 43 isolated, 43 non-isolated))	Contact isolation	- Non-isolated patients gave a median hospital rating of 8 (IQR 7-10) while isolated patients gave a median hospital rating of 9 (IQR 8-10) (p=0.02) on a scale of 1-10	- CAHPS Hospital Survey - Unclear if results are generalizable to pandemic setting

Reference	Study type	Population	Intervention (PPE, isolation, masking, etc.)	Findings	Notes
				- Isolated patients and non-isolated patients did not differ with respect to whether they would recommend the hospital to a friend - 95% of isolated patients understood that isolation was for their benefit and the benefit of others - 62% of participants felt that isolation improved their care, while 8% felt that isolation worsened the care they received from healthcare providers	
Giannaccare et al., 2020	Cross-sectional survey	Medical students in Italy (n= 107)	"face mask"	- Eleven subjects (10.3%) described appearance or worsening of ocular discomfort symptoms, and 21 (19.6%) reported the need for daily use of tear substitutes. - The mean score of Ocular Surface Disease Index was 21, and 61 subjects (57%) scored ≥ 15 (pathological values)	Potential risk of sampling bias and response bias
Gupta, Singh & Gupta, 2020	Cross-sectional survey	Healthcare workers in India (n= 100)	Surgical mask, N95 mask or cloth mask for 4-12 hours per day (66% of participants)	- 62% indicated fogging of spectacles which hindered their vision. - 56% expressed that mask was very uncomfortable due to the pain caused by elastic bands. - 55% reported suffocation and difficult and heavy breathing, especially while climbing stairs. - 49% reported excessive sweating inside the masked area of the face. - 44% expressed reduced quality and volume of speech. - 43% conveyed development of skin marks and scarring due to pressure. - 40% reported pain and redness due to friction. - 28% revealed a false sense of security while wearing the mask. - 19% reported significant ear discomfort due to constant pull from mask - 16% pointed out increased incidence of furunculosis on face. -14% manifested increased incidence of eyes irritation and claustrophobia	- May have limited generalizability to Alberta due to cultural differences and differences in PPE supply

Reference	Study type	Population	Intervention (PPE, isolation, masking, etc.)	Findings	Notes
				- 4% indicated increased sense of embarrassment due to use of face mask	
Hampton et al., 2020	Simulation study	Representatives from hospital ENT department (n=5)	"PPE" (not described)	- PPE significantly affected speech processing in simulated operating theatre settings but not in simulated office, emergency department, or intensive care settings. - Bamford–Kowal–Bench sentence test scores were significantly lower for subjects wearing PPE (median score = 58) compared to those without PPE (median score = 92) in an operating theatre simulated environment ($Z = -2.02$, $p = 0.04$) - Increasing voice volume whilst wearing PPE significantly increased Bamford–Kowal–Bench sentence test scores (median score = 86) compared to normal speech volume when wearing PPE (median score = 58; $Z = 2.03$, $p = 0.04$) - Louder background environments, such as an operating theatre setting, produced the most pronounced (statistically significant) effect on speech comprehension	
Hines et al., 2020	Cross-sectional survey and qualitative study	Healthcare workers in the United States (Maryland) (n= 1152)	Respirators – N95 mask, elastomeric respirator, or PAPR	- HCWs recognized that while mask use did not create conflict with patients or family members, it limited the ability to be seen smiling, and they speculated that a transparent mask might be better - Most respondents did not find that use of respirators and PPE impacted their ability to perform patient care (62%) or that it was inconvenient (51%) - If respirator use interfered with their ability to perform care, it would influence their compliance with respirator use - More PAPR users (27%) than N95 (17%) and elastomeric (16%) users agreed that respirator use interferes with patient care.	Risk of response bias
Houghton et al., 2020	Systematic review	Healthcare workers (n= 20 included studies)	n/a - ability to adhere to IPC guidelines	- Both information on, and rationale for IPC guidance, was seen as important, but healthcare workers reported that they needed support to source	

Reference	Study type	Population	Intervention (PPE, isolation, masking, etc.)	Findings	Notes
				appropriate evidence for their own knowledge and practice with respect to PPE - Ill-fitting PPE or PPE perceived to be ineffective at stopping transmission may impact adherence to PPE guidelines - Wearing facemasks could be seen as creating a barrier between the healthcare worker and patients, which could make patients feel uncomfortable, particularly children who may become frightened. - Facemask/respirator use is associated with putting 'barriers up' between themselves and their patients and perceived a negative impact on their relationships with patients and ability to provide care. - Social norms and culture of wearing PPE improves adherence – if all staff members are wearing PPE, there is improved attention to guidelines - Substantial physical discomfort of wearing PPE is believed to act as a barrier to adherence. These discomforts included difficulty in donning multiple PPE; difficulty in breathing and feelings of suffocation; exhaustion and fatigue; sweating, dizziness, dehydration and irritation; backache; and glasses fogging up - Continuous / Full PPE may prevent staff from fully utilizing their breaks or properly caring for their own needs (toileting, hydrating, eating) to mitigate the inconvenience of donning and doffing	
Hu et al., 2020	Cross-sectional survey (purposive sampling)	Healthcare workers in China (n= 61)	N95 masks, latex gloves, protective clothing	- N95 mask: 58 (95.1%) reported adverse reactions, including nasal bridge scarring (68.9%), facial itching (27.9%), skin damage (26.2%), dry skin (24.6%), and rash (16.4%) - All people with skin reactions developed these reactions after using the N95 mask for 12 hours a day over an average of 3.5 months - HCWs using surgical masks, cloth masks, and paper masks did not report any adverse skin reactions	

Reference	Study type	Population	Intervention (PPE, isolation, masking, etc.)	Findings	Notes
				- Latex gloves: 54 (88.5%) reported adverse skin reactions, including dry skin (55.7%), itching (31.2%), rash (23.0%), and chapped skin (21.3%) - For an average of 3.5 months, latex gloves were used for an average of 10 hours. No one reported that the use of plastic gloves and cloth gloves can cause adverse skin reactions - Protective clothing: 37 (60.7%) reported adverse skin reactions, including dry skin (36.1%), itching (34.4%), rash (11.5%), and wheals (3.28%). - The incidence of adverse skin reactions to the N95 mask was 95.1%, that to latex gloves was 88.5%, and that to protective clothing was 60.7%.	
Jesus, Dias & Figueiredo, 2019	Qualitative study	Hospital patients in Brazil (n=19)	Airborne or isolation precautions	- Positive perceptions were because individual rooms provide more privacy and comfort for these interviewees. The possibility of being in a private room and with companion was pointed out as a bonus of being hospitalized under precautions. - There was also the sense of protection offered by the precaution implemented - The unfavorable perceptions emerged were feelings of loneliness, anguish, sadness, and despair for being in a small room, with restraint of exits - stigma of isolation is observed as a result of being separated from other patients.	- Unclear if generalizable to pandemic setting
Jiang et al., 2020	Cross-sectional survey	Medical staff in China (n= 4308)	Continuous (8-12 hrs) personal protective equipment (PPE), including protective masks, goggles, face shield, and protective gowns.	- 1,396 respondents (32.4%) and 2,910 respondents (67.6%) wore grade 3 and grade 2 PPE, respectively. The average daily wear time was 7.7 ± 2.9 h, with 14.3% (615 respondents) and 85.7% (3,691 respondents) daily wear time ≤4 and >4 h, respectively - device-related pressure injury (DRPI), moisture-associated skin damage (MASD) and skin tears (ST) - The overall prevalence was 42.8% (95% CI 41.30–44.30), and the prevalence of DRPI, MASD, and ST was 30.0% (95% CI 28.69–31.41), 10.8% (95% CI 9.91–11.82), and 2.0% (95% CI 1.62–2.40)	- High risk of sampling bias, response bias, recall bias due to online methodology

Reference	Study type	Population	Intervention (PPE, isolation, masking, etc.)	Findings	Notes
				- 386 respondents (27.4%) had 2 or more types of injuries (coinjuries), and 1,080 respondents (76.8%) had 2 or more anatomical part injuries (multiple site injuries) - Prevalence of skin injury was higher in people wearing grade 3 PPE than grade 2 PPE (88.5% vs. 21.0%, $p < 0.001$), in people with daily wearing time >4 h than in people with daily wearing time ≤4 h (47.3% vs. 18.7%, $p < 0.001$) - Mulitvariate logistic regression analysis indicated that sweating (95% CI for [OR] 87.52–163.11), daily wearing time (95% CI for OR 1.61–3.21), male (95% CI for OR 1.11–2.13), and grade 3 PPE (95% CI for OR 1.08–2.01) were associated with skin injuries	
Kang et al., 2018	Qualitative study	Nurses in Korea during MERS (n= 27)`	n/a	- “It's so sweaty and hard to breathe with it. It is hard to work and see clearly while wearing it (protective measures) and I feel dizzy when wearing it for long hours.” - “(We were) sweating, (find it) hard to breathe; it was difficult to work wearing personal protective equipment.” - Nurses from one hospital stated that they stayed in the isolation room for a maximum of 2 hours while wearing their PAPR and then came out; they stayed in the anteroom (a room in front of the negative pressure isolation room) and went back into the isolation room when needed - Wearing the PAPR made them difficult to communicate with patients and other nurses in isolation anterooms. They said that it was not easy to communicate with patients on a respirator while wearing PPE as noise from the respirator or other machines and face shields of their PAPR impeded communication	- Unclear if PAPR use limits generalizability to Alberta

Reference	Study type	Population	Intervention (PPE, isolation, masking, etc.)	Findings	Notes
Karki, Leder & Cheng, 2013	Retrospective cohort study	Patients with VRE admitted to Alfred hospital in Australia (n= 246)	Contact precautions	- 109 patients had at least 1 formal complaint/adverse incident; 186 incidents were reported before initiation of CPs and 214 after commencement of CPs. - During the study period, the mortality among patients was 29% (72/246). - The median lengths of stay per admission before and after the initiation of CPs were 9 (IQR, 4–20) and 8 (IQR, 4–16) days, respectively. - A significantly higher rate of medication administration errors was observed following the implementation of CPs (incidence rate ratio (IRR), 1.55; 95% CI, 1.01–2.41) - The IRR of non-pressure injuries was 3.24 (95% confidence interval [CI], 1.16–11.17); however, the IRR of pressure injuries was 1.91 (95% CI, 0.82–4.77) and not statistically significant - For other adverse outcomes reported, including uncomplicated falls, drug prescription and pharmacy-related errors, diagnosis-related errors, clinical management errors, and patient support failures, no statistically significant differences were found - A significantly higher risk of potentially preventable non-pressure-related injuries (including falls from bed, skin tears, or self-injuries) and of medication administration errors in patients under CPs and a nonsignificant increase in pressure injuries	- Study poorly described; low quality article - Included in Berry et al., 2020
Khan, Khakoo & Hobbs, 2006	Cross-sectional survey	Healthcare workers in United States (West Virginia) (n=368)	Contact isolation precautions	- Physicians perceived care of contact isolation patients as being more prone to adverse effects, compared with nursing staff (63% versus 32%; *P* = .0001) - Nursing staff in general disagreed with there being delays in medication delivery to contact isolation patients; 88%, versus 64% of physicians (*P* = .0006) - Physicians reported being less likely to examine patients who were in contact isolation when compared with nurses (59% versus 4%; *P* = .0001).	- Potential for response bias - Unclear if findings from non-pandemic times apply to COVID-19

Reference	Study type	Population	Intervention (PPE, isolation, masking, etc.)	Findings	Notes
				- Attending physicians were less likely to examine patients in contact isolation (69%) compared with resident physicians (58%; *P* = .0001) - Overall 96% of the nurses, compared with 40% of respondents from the physician group, reported being less likely to examine patients in contact isolation (*P* = .0001) - The HCWs responsible for more than 3 patients in contact isolation at a time and those with an increasing number of total patients also tended to agree with being less likely to examine their patients (*P* = .0001) - As the total number of patients and those in contact isolation under the daily care of the HCW increased, more respondents perceived an inability to efficiently respond to the needs of contact isolation patients (*P* = .005 and .01, respectively).	
Khoo et al., 2005	Cross-sectional survey	Healthcare workers in Singapore during SARS (n= 51)	Powered air-purifying respirator (PAPR)	- The majority of respondents who used both the 3M and Stryker PAPR found it to be at least tolerable with respect to comfort - The majority (98% and 95% for the 3M and Stryker PAPR, respectively) found the level of visual impairment attributable to the PAPR to be at least acceptable - A total of 14% of respondents found the hearing impairment when using the 3M PAPR to be significant or unacceptable, while it was significant for only 5% when using the Stryker PAPR. Concomittant use of the N95 mask impacted vocal volume and ability to speak - About two-thirds of respondents agreed (22%) or strongly agreed (42%) that they looked frightening to their patients whenever they used the PAPR.	- Potential risk of selection and response bias - Unclear generalizability to Alberta since routine PPE does not include PAPR
Klimek et al., 2020	Descriptive study	Healthcare workers (n=17); other patients (n= 29)	FFP2 (N95) respirators	- New-onset symptoms of rhinitis, such as sneezing, itching, nasal blockage, and/or watery nasal discharge after wearing their FFP for a minimum of 2 hours or longer	

Reference	Study type	Population	Intervention (PPE, isolation, masking, etc.)	Findings	Notes
				- Endoscopic signs of irritation and edema with mucosal swelling and watery secretions were mainly found in the area of the inferior and middle turbinates; irritation subsided after 3 days of mask absence - After wearing FFP2 respirators for a minimum of 3 hours, a mean number of 3.8 ± 7.9 (mean ± SD) polypropylene fibres were found in nasal lavage fluid per nasal side with a maximum of n = 47 fibres in the lavage fluid of one patient, while the number decreased to 0.4 ± 0.7 (mean ± SD) after 3 mask-free days ($p < 0.01$)	
Kuo et al., 2020	Cross-sectional survey	Healthcare workers in Taiwan (n=752)	n/a (PPE experience)	- Mean total score on perceived work stress was 47.7 ± 16.8, representing moderate stress. - The main stressor for the hospital staff was discomfort caused by protective equipment - Nurses' stress could be attributed more to their fear of social isolation, discomfort due to protective equipment, and burden of patient care. In contrast, medical technicians had a higher degree of stress related to difficulties and anxieties related to infection control.	- Stress caused by PPE discomfort has implications for psychological safety and workplace morale - Risk of response bias (web survey) - May have limited generalizability
Lau, Majumdar & McAlister, 2016	Prospective cohort study	Patients admitted to Internal Medicine in Alberta (n= 495)	Contact, droplet, or airborne precautions (“isolated”)	- Seventy-five (18%) patients were isolated during their admission (contact precautions $n = 46$ (9%), respiratory precautions $n = 29$ (7%)) - Isolated patients were more likely to be unemployed, less likely to be retired, and more likely to identify as First Nations compared to non-isolated patients - Length of stay, depression, anxiety, health-related quality of life, and satisfaction scores were similar at discharge - At 30 days, 81 (16%) patients had been readmitted, 13 (3%) had died, and 131 (26%) had attended the ED on one or more occasions. - The overall 30-day rate of readmission or death was 17% ($n = 85$), and it was not different between isolated and non-isolated patients	- Unclear if findings will be applicable to pandemic setting

Reference	Study type	Population	Intervention (PPE, isolation, masking, etc.)	Findings	Notes
				- Similar 30-day rates were also observed among isolated and non-isolated patients for readmission (aOR 1.19, 95% CI 0.61–2.33), death (aOR 2.78, 95% CI 0.74–10.46), and one or more ED visits post-discharge (aOR 1.03, 95% CI 0.57–1.84).	
Lawrence et al., 2020	Pre-clinical PPE assessment	Otologists (n=20)	1) a full-face respirator (Promask; 3M Scott, Munroe, NC; n = 5 otologists) 2) a modified full-face snorkel mask[11] (n = 10 otologists) 3) and the ensemble of a half-face mask (filtering facepiece [FFP]3 or FFP2) and safety goggles or spoggles (n = 5 otologists)	- Communication was most degraded using the full-face snorkel mask, with participants' performance around 50% correct across all conditions and listener positions. - On average, communication scores for the half-face mask (FFP2 or FFP3) were superior to both of the full-face mask options. - no concerning changes were observed in heart rate, O_2 saturations, or $ETCO_2$ levels across all participants for all mask types. - Most participants rated the comfort associated with the half-face (FFP3 or FFP2) mask as good, a higher proportion than either of the full-face masks - The safety spoggles had a negligible effect upon the visual field (radius = 96%). The safety goggles, full-face snorkel mask, and full-face respirator all caused a substantial reduction of the radius of the visual field to 55%, 40%, and 18%, respectively - Most participants only tolerated wearing the full-face snorkel mask for less than 60 minutes and, again, the majority also stated that they would not personally use it for CI surgery. - Restriction of the visual field and a lack of binocular vision were major concerns for all of these PPE options.	
Lee et al., 2020	Cross-sectional survey	Healthcare professionals from India and Singapore (n = 165)	Liquid impermeable gowns, gloves, goggles, surgical caps, and masks	- Agreement with the following statements, but more strongly in Singapore than in India: 1. “Heat stress can degrade productivity” 2. “Heat stress can degrade judgment” 3. “Heat stress can negatively affect me psychologically” 4. “Heat stress can negatively affect emotions”	- Limited generalizability to Alberta because of climate differences - Risk of response bias

Reference	Study type	Population	Intervention (PPE, isolation, masking, etc.)	Findings	Notes
				- Respondents suggested that they avoid taking breaks and avoid hydration to preserve their PPE and avoid the inconvenience of the donning/doffing procedures - Thermal stress: Symptoms such as thirst (*n* = 144, 87%), excessive sweating (*n* = 145, 88%), exhaustion (*n* = 128, 78%), and wanting to go to comfort zones (*n* = 136, 84%) were highly reported.	
Lim et al., 2006	Cross-sectional survey	Healthcare workers during SARS outbreak in China (n= 212)	N95 face mask	-79 (37.3%) reported headaches while wearing N95 masks (27 (37.3%) had pre-existing headaches, 52 (62.7%) had no pre-existing headaches, 25 (31.6%) had migraine headaches, 43 (54.4%) had tension-type headaches, 11 (13.9) had unspecified headaches and none had cluster headaches) - Pre-existing headaches (*P*=0.041; OR= 1.97; 95% CI 1.03–3.77) and continuous wear of the N95 face-mask (*P*=0.053; OR=1.85; 95% CI 0.99–3.43) were associated with headaches amongst N95 face-mask users - 26 (32.9%) suffered more than six headaches in a month, six (7.6%) had taken sick leave (because of headache) from March 2003 to June 2004 (mean 2 days; range 1–4 days) and 47 (59.5%) had headaches that required the use of abortive analgesics	- Response bias and recall bias
Lin et al., 2020	Cross-sectional survey	Healthcare workers in China (n= 376)		- Adverse skin reactions were reported by 280 respondents (74·5%). Of note, this rate was much higher than the rate of occupational contact dermatitis (31·5%) in HCWs under normal working conditions, and that of adverse skin reactions (21·4–35·5%) during the SARS outbreak - Duration with full-body PPE of > 6 h per day (OR 4.26, *P* < 0·001) were associated with increased adverse skin reactions. - Hands, cheeks and nasal bridge ranked as the three most commonly affected areas, reported by 237	- Risk of response bias and recall bias

Reference	Study type	Population	Intervention (PPE, isolation, masking, etc.)	Findings	Notes
				(84·6%), 211 (75·4%) and 201 (71·8%) respondents, respectively. - Promoting education on proper PPE, and restricting the duration of wearing PPE to no more than 6 h per day would help minimize adverse skin reactions	
Morgan et al., 2011	Retrospective cohort study	Patients admitted for Acute Myocardial Infarction (AMI), Congestive Heart Failure (CHF), Pneumonia (PNA) and Surgical Care Improvement Project (SCIP) in Maryland (n= 6716)	Contact isolation precautions	- Contact Isolation was not associated with worse CHF process-of-care quality composite measure (OR 1.0, 95% CI 0.5–2.2). - Contact Isolation was not associated with worse AMI process-of-care quality composite measure (OR 0.7, 95% CI 0.1–5.0) - The composite pneumonia process-of-care measure was significantly more likely to be missed in patients on Contact Isolation (6.8% vs. 21.4%, OR 0.3, p<0.01) - Three individual CMS process-of-care quality measures were less likely to be met in patients on Contact Isolation (pneumococcal vaccine, influenza vaccine, smoking cessation) - Contact Isolation was not statistically significantly associated with worse SCIP process-of-care quality composite measure (OR 0.8, 95% CI 0.5–1.3)	
Ong et al., 2020	Cross-sectional survey	Healthcare workers in tertiary care in Singapore (n= 158)	N95 mask and eye protections	- On average, respondents donned the N95 face mask for 18.3 days over the 30-day period, with a mean of 5.9 hours per day. Goggles were used as protective eyewear in the majority [153/158 (96.8%)]. Protective eyewear was worn on an average of 18.2 days over the 30-day period, with a mean of 5.7 hours per day - 128 (81.0%) reported de novo PPE-associated headaches when they wore either the N95 face mask, with or without the protective eyewear. - Discomfort experienced by the participants corresponded to the areas of contact from the face mask or goggles and their corresponding head straps.	- Risk of recall bias and response bias

Reference	Study type	Population	Intervention (PPE, isolation, masking, etc.)	Findings	Notes
				- Onset of headache was less than 60 minutes for the majority of respondents [104/128 (81.3%)] and [113/128 (88.3%)], respectively). After removal of PPE, the attributed headache resolved spontaneously within 30 minutes in the majority for both N95 face mask [113/128 (88.3%)] and protective eyewear [114/128 (89.1%)] - Headache intensity was graded as mild by 92 out of 128 (71.9%) respondents. Associated symptoms were experienced by 30 out of 128 (23.4%) respondents, and comprised of nausea and/or vomiting, photophobia, phonophobia, neck discomfort, and movement sensitivity - When PPE usage patterns were evaluated, N95 face mask (OR = 1.59, 95% CI 1.15-2.18; P < .001), protective eyewear (OR 1.60, CI 1.13-2.25; P < .001) or using them together (OR = 1.50, 95% CI 1.09-2.07; P = .002) for >4 hours per day had a higher chance of developing headache	
Palinkas et al., 2020	Ethnographic study	Healthcare workers in Seattle (n= 5 participant observers)	"PPE"	- Concerns about preserving PPE limits the ability of care providers to provide care as needed to patients - "*I think that some people do feel apprehensive that they can't see your face but also that you know you may be a risk to them, and sort of I feel like sometimes sends that signal even though you're trying to obviously do the right thing and protect them. I mean classically people have worn masks in hospitals when they have been sick, right?"* - the time involved in 'donning and doffing' created delays in performing procedures and the perceptual separation from patients created by the PPE - POs noted changes in patient–provider interactions resulting from social distancing and PPE use - Despite concerns expressed by staff over the potential effects of delays in testing for COVID-19 and the challenges associated with social distancing and PPE use, the overall quality of care delivered to	- Unclear if results can be generalized

Reference	Study type	Population	Intervention (PPE, isolation, masking, etc.)	Findings	Notes
				patients does not appear to have been significantly affected. - Workload did increase in many instances due to the imposition of new procedures related to PPE	
Parush et al., 2020	Cross-sectional survey	Healthcare professionals (physicians, nurses, paramedics) in Israel (n=722) and Portugal (n=301)	Full "Level 1" PPE (full body coveralls with hood, eye protection, mask, gloves)	- high agreement across professions and in both countries that the use of the PPE is highly uncomfortable: 78% (n=539/688) in Israel and 87% (n=328/377) in Portugal. - Only 27% (n=188/684) of the respondents from Israel and 45% (n=163/365) from Portugal, of all the professions, indicated that donning the PPE was difficult - Agreement was high across professions and the two countries regarding difficulty in seeing what is going on around while using the PPE: 89% (n=697/763) in Israel and 84% (n=317/376) in Portugal - Significantly higher proportions of respondents from Portugal than Israel reported difficulties in doffing the PPE 77% vs. 44%, *P*<.001); in hearing (64% vs. 50% *P*<.001); in understanding speech (65% vs 47% *P*<.001); in understanding the situation (69% vs 54%, *P*<.001); in being able to think clearly (57% vs 43%, *P*<.001); and in being able to make decisions (50% vs 39%, *P*<.001). - Increased discomfort with the PPE was related to increased difficulties in hearing and speech comprehension, which were related to increased difficulties in understanding the surroundings	- Purposive and convenience sampling, high risk of response bias - Differences in Level 1 PPE (incl. Training and culture) in each country may contribute to human factors differences
Pei et al., 2020	Descriptive cross-sectional survey	Healthcare workers in China (n= 484)	Biosafety level 1, 2 or 3 (undefined)	- 18.2%, 64.1% and 17.2% of participants were equipped with biosafety level 1, 2 or 3, respectively - More than half of the participants wore the protective suit between 4 and 6 h at a time and 9.1% of them kept the suit on for longer than 6 h - Among the 484 participants, 73.1% suffered from various skin lesions. The lesions manifested as erythema (38.8%), prurigo (22.9%), blisters (13.8%),	- High risk of response bias

Reference	Study type	Population	Intervention (PPE, isolation, masking, etc.)	Findings	Notes
				rhagades (13.6%), papule/oedema (12.8%), exudation/crust (6.8%) and lichenification (5.6%) - Lesions were located on the face (47.1%), followed by the hands (27.5%), limbs (15.7%), truncus (12.6%) and the whole body (2.3%) - medical staff with level 2&3 protection were more likely to experience itching than those using primary protection ($P = 0.0121$) - More advanced protection ($P = 0.0016$), higher working frequency ($P < 0.001$) and longer wearing times of protective suits ($P = 0.0016$) were more correlated with the appearance of facial skin lesions ($P = 0.0006$)	
Perna et al., 2020	Literature review	n/a - rigourous studies of effects of respiratory protection devices (RPD)(n= 5 included studies)	Common RPDs among HCWs and the general population are surgical facemasks (SMs) and filtering facepiece respirators (FFRs)	- Four studies reporting on objective measures of respiration suggest that RPDs may alter the users' natural breathing patterns and make breathing more difficult. This is due to an increase in breathing resistance (resulting in increased breathing effort and hypoventilation) accumulating and inhaling CO_2 in the dead volume in the facepiece, and reduced O_2 concentrations on inhalation - Sensitivity to respiration differences (breath-holding, hyperventilation, hypoxia, hypercapnia) may trigger panic symptoms in panic-prone individuals - The use of RPDs has been associated with other effects, including increased air temperature in the RPD cavity (up to approximately 32°C–33°C) with sweat accumulation, which may add a further burden to breathing and general discomfort - individuals vulnerable to panic may be at higher risk of relevant discomfort while wearing RPDs, thereby reducing their tolerance for these devices,	
Pineles et al., 2018	Observational study	Healthcare workers in long-term care facilities in the United States	Patients/residents on isolation precautions	- 999 hours of observation were conducted across 8 VA nursing homes - Residents on any type of isolation received an average of 4.73 visits per hour of observation compared with 4.21 for non-isolation residents	

Reference	Study type	Population	Intervention (PPE, isolation, masking, etc.)	Findings	Notes
				(*P*<.01), a 12.4% increase in visits for residents in isolation - A similar result was seen in average number of HCW visits per hour, which were 15.1% higher in residents in isolation than those who were not (3.43 vs 2.98; *P*<.01) - For every hour of observation, residents on any type of isolation received an average of 22.1 visit minutes compared with 19.9 visit minutes for residents not in isolation (*P*<.01) - Residents in isolation received, on average, 3.53 resident care activities per hour of observation, compared with 2.46 for residents not in isolation (*P*<.01) - Hand hygiene compliance on entry between residents in isolation and residents not in isolation was the same (38% vs 38%; *P*=.99)	
Purssell, Gould & Chudleigh, 2020	Systematic review & meta-analysis	Hospitalized patients on isolation precautions (n= 26 studies)	Isolation precautions	- Pooled standardized mean difference (SMD) for anxiety was 1.45 (95% CI 0.56 to 2.34); although within this there was significant heterogeneity - For depression, the SMD was 1.28 (95% CI 0.47 to 2.09); again with significant heterogeneity - Studies not reporting the raw data showed that contact precautions were associated with depression OR 1.4 (95% CI 1.2 to 1.5) but not anxiety OR 0.8 (95% CI 0.7 to 1.1) in the non-ICU population - There was also an association with delirium (OR 1.40 (95% CI 1.24 to 1.51)); although this was primarily among those who were newly diagnosed as needing isolation (OR 1.75 (95% CI 1.60 to 1.92, p<0.01)) rather than those who had been under contact precautions for their entire stay - For those outcomes associated with quality, the median RR (with positive outcomes reversed so a higher RR is associated with a worse outcome) was 0.94 (IQR 0.92–0.98), satisfaction 0.95 (IQR 0.89–1.01) and adverse events was 1.27 (0.91–2.5)	

Reference	Study type	Population	Intervention (PPE, isolation, masking, etc.)	Findings	Notes
Purushothaman et al., 2020	Cross-sectional survey	Healthcare workers in India (n= 250)	Surgical masks and N95 respirators for a minimum of 4 h per day	- 48.8% experienced generalised nasal discomfort, 30.3% dry nose, 26.1% burning sensation in the nose, about 52.0% developed itchy nose, 56.0% acne in the face, 39.0% experienced redness on the face and 67.6% developed excessive sweating around the mouth - About 30.0% developed pain on the nose and 45.2% had pain behind the ear which are possibly due to the tight-fitting masks - 58.2% of the participants developed trouble breathing on exertion while wearing masks (probably due to the tight mask causing hypercapnic hypoxic environment leading to numerous physiological alterations such as cardio-respiratory stress and metabolic shift) - Inadequate hydration while wearing PPE leads to dry mouth, halitosis and sore throat - A small proportion of healthcare workers were observed with the symptoms of altered smell (7.2%), sense of nasal stuffiness (30.4%), nasal block (22.9%), cracking sensation (9.6%), crusting in the nose (15.7%) and blood on tissue paper (1.6%)	- Results may have limited generalizability to Alberta - High risk of response bias
Ribeiro et al., 2020	Descriptive, observational cross-sectional study	Volunteers in Brazil recruited by web and social media (n= 468)	- Working Group (WG), with 289 individuals who wore the face masks for professional and essential activities during the pandemic - Essential Activities Group (EAG), which comprised of 179 individuals who wore the face masks only to perform essential activities during the pandemic - Masks were N95, disposable surgical mask, or cloth mask	- There was a higher frequency of usage of cloth masks in the EAG (P< 0.001), especially by participants who were working from home (P< 0.001) - Significantly higher scores of vocal fatigue symptoms in the domains of tiredness and voice impairment (P = 0.001) and avoidance of voice use (P = 0.046) in the WG as compared with the EAG - Significantly higher frequency (P < 0.001) and intensity (P < 0.001) of vocal tract discomfort in the WG relative to the EAG - Increase in vocal effort, difficulty in speech intelligibility, difficulty in coordinating speech, and breathing in both groups, and reduction of auditory feedback when the conditions with and without face masks were compared (P < 0.001)	

Reference	Study type	Population	Intervention (PPE, isolation, masking, etc.)	Findings	Notes
				- Higher frequencies of vocal effort (*P* = 0.017), difficulty with speech intelligibility (*P* = 0.003), and difficulty in coordinating speech and breathing (*P* = 0.003) were observed in those wearing the face mask in the WG when compared to the EAG	
Saint et al., 2003	Prospective cohort study	Patients admitted to general medicine (n= 139); Observations of attending physician and senior residents	Contact precautions for antibiotic resistant infection	- 31 (22%) of patients in contact isolation. - Senior medical residents examined 26 of 31 patients (84%) under contact precautions versus 94 of 108 patients (87%) not under contact precautions (n.s.) - Attending physicians, in contrast, examined 11 of 31 patients (35%) under contact precautions versus 79 of 108 patients (73%) not under contact precautions (relative risk = 0.49; 95% confidence interval = 0.30-0.79; *P* < .001).	Differences in physician activities may not be due to isolation (could be due to delegation of duties)
Shack et al., 2020	Cross-sectional survey	Pediatric health workers in Israel (n= 356)	"Face masks"	- 82% reported that mask-wearing interrupts their ability to interact with children - 62% reported that children are more fearful of mask-wearing clinicians - 59% experienced difficulty effectively assessing or treating patients while wearing a mask (p<0.005). -Significant differences in clinicians' reported difficulty in engaging with patients when comparing mask-wearing during the pandemic to previous routine practice. This effect was more pronounced at younger ages; for patients aged 6 months to 2 years, 20% of all clinicians reporting their experiences as 'difficult' or 'very difficult' with mask-wearing during the pandemic, as opposed to 4% during previous routine practice.	- High risk of sampling bias - Perceptions from pediatric specialists, not direct evidence from patients / families
Spence & McQuaid, 2011	Retrospective chart review	Acute care patients (n=8772)	Isolation precautions	- 712 (8.1%) were placed in precautions other than standard - 301 (38.6%) of 780 incident reports filed and categorized as being potentially related to patient harm	Included in Purssell, Gould & Chudleigh (2020)

Reference	Study type	Population	Intervention (PPE, isolation, masking, etc.)	Findings	Notes
				- Forty-five incident reports were in the 712 patients in precautions and 256 in the remaining 8,060 patients. These differences are statistically significantly ($\chi^2 = 19.5$, $P \leq .001$). - The majority of the adverse events, 43 of 45, occurred in the 525 patients who were in contact precautions with 1 adverse event each in patients placed in droplet and preventive precautions - The differences in the number of adverse events categorized as medication, intravenous fluid, and treatment errors between isolated and standard patients (25 of 692 and 152 of 7,956, respectively) were highly significant ($\chi^2 = 9.01$, $P \leq .005$).	
Stelfox, Bates & Redelmeier, 2003	Case-control study	- General cohort (patients admitted with all diagnoses between January 1, 1999, and January 1, 2000; n=78); - Disease-specific cohort (patients admitted with a diagnosis of congestive heart failure and history of MRSA between January 1, 1999, and July 1, 2002; n=72). - Two matched controls were selected for each isolated patient (n=156 general cohort controls and n=144 disease-specific cohort controls).	Adults on isolation precautions for MRSA	- isolated patients were more likely to have their vital signs incompletely recorded (14% vs 9%; P<.001) and to have days with no vital sign recordings (5% vs 1%; P=.02) at all - Isolated patients were twice as likely to have vital signs not recorded as ordered (51% vs 31%; P<.001), and they were also more likely to have days with no nursing narrative notes (14% vs 10%; P< .001) or physician progress notes (26% vs 13%; P< .001) recorded - Isolated patients were far less likely to have a stress test or angiogram if they had angina (8/59 [14%] vs 42/93 [45%]; P<.001), to have their weight recorded on at least half of the days of the hospitalization (58% vs 87%; P=.01), or to have an evaluation of left ventricular function while in the hospital (57% vs 69%; P=.049). - Isolated patients were less likely to have documentation of congestive heart failure education (18/63 [29%] vs 69/136 [51%]; P=.004) and timely (within 4 weeks) follow-up appointments scheduled (15/63 [24%] vs 63/ 136 [46%]; P=.001)	- Unclear if findings will translate to COVID-19, when droplet precaution PPE is the norm rather than the exception - Included in Berry et al., 2020 - Included in Purssell, Gould & Chudleigh, 2020

Reference	Study type	Population	Intervention (PPE, isolation, masking, etc.)	Findings	Notes
				- Isolated patients had longer hospitalizations and higher rates of adverse events compared with control patients - . Isolated patients were twice as likely as control patients to experience adverse events (31 vs 15 adverse events per 1000 days; P<.001) during their hospital stay - Twelve isolated patients (8%) submitted unsolicited complaints to the hospital compared with only 3 control patients (1%)	
Tabah et al., 2020	Cross-sectional survey (web-based)	Healthcare workers in 90 jurisdictions (n= 2711)	PPE (described in findings)	- most respondents reported use of FFP2/N95 masks (1557; 58%), Surgical masks were reportedly used for routine care in 289 (15%) cases but infrequently (47, 2%) for intubations. Waterproof long sleeve gowns (1623; 67%), and face shields/visor (1574; 62%). - The median duration of a shift while wearing PPE without the ability to take a break (PPE-Shift) was 4 h (IQR 2, 5 h). This was similar for nurses and doctors. Adverse events were associated with longer PPE shifts. - Adverse effects were reported by 80%, including heat (1266, 51%), thirst (1174, 47%), pressure areas (1088, 44%), headaches (696, 28%), inability to use the bathroom (661, 27%) and extreme exhaustion (4924, 20%).	- High risk of response bias
Tan et al., 2006	Qualitative study	Family physicians after SARS in Singapore (n=8)	“PPE”	- Practice pattern was also modified as one participant decided to talk less and hastened the consultation in view of the dyspnoea - There were moments of complacency when the participants felt all right to remove the mask intermittently to allow “normal” breathing but compliance was improved after the death of their doctor friend from SARS in the hospital - The participants, who wore gowns, pointed out the inconvenience during toilet breaks	- Risk of recall bias

Reference	Study type	Population	Intervention (PPE, isolation, masking, etc.)	Findings	Notes
				- The participants highlighted the physical discomfort during prolonged use of the N95 mask, ranging from breathing difficulty, headache to the development of allergic facial rash around the mask - The discomfort from the N95 mask had severely impaired the ability to carry out the consultation had resulted in one participant switching to the triple ply surgical mask - They also had to handle some of their other patients' adverse perception of their PPE (concern and anxiety) with reassurance and explanation. - The participants claimed that their patients' reactions to the PPE were varied and ranged from amusement to apprehension - The patients perceived the wearing of PPE by their family physicians as a sign that they could have been exposed to SARS patients and thus taking up these precautions. The patients inferred that their family physicians, in turn could endanger their health by transmitting the SARS virus to them - One participant highlighted the need to explain to patients the use of PPE to rectify any erroneous perception. He made it clear to his patients that wearing the PPE would be a key measure to safeguard their health with mutual benefits	
Teh et al., 2020	Observational study	Retrospective review of endoscopies performed in 2020 and a similar period in 2019 (n=247)	Enhanced PPE: f N95 filtering face piece (FFP) respirator, face shields, and hairnets, in addition to the standard personal protective equipment (SPPE) of water-resistant gown and gloves	- No significant difference in median time to cecum (TTC) (10.0 vs 10.0 min, P =0.524) and total procedure time (22.5 vs 23.0 min, P =0.946) between the SPPE and EPPE groups - There was no statistically significant difference in adenoma detection rate (ADR) (29.8% vs 21.6%, P =0.141) and polyp detection rate (PDR) (50.4% vs 40.5% P =0.120) between the EPPE and SPPE groups. Cecal intubation rate (CIR) (99.2% vs 100%, P =0.346) was also similar between the two groups.	

Reference	Study type	Population	Intervention (PPE, isolation, masking, etc.)	Findings	Notes
Tran et al., 2017	Retrospective cohort study	Patients admitted to general medicine in Toronto (n= 17649)	Isolation precautions	- 1506 patients isolated for respiratory illnesses and 745 patients isolated for MRSA - Among the respiratory isolation cohort, 207 (13.7 %) were readmitted to the hospital, and 164 (10.9 %) visited the ED within 30 days after discharge. Their mean cost for hospitalization was CAD $7254, and their mean length of stay was 8.5 days - Among the cohort with MRSA, 141 (18.9 %) were readmitted to the hospital, and 85 (11.4 %) visited the ED within 30 days of discharge. Their mean cost for hospitalization was CAD $12,129, with a mean length of stay of 12.8 days - Individuals isolated for respiratory illnesses were not significantly more likely to experience a 30-day readmission or ED visit, death, or adverse event during hospitalization or to file a formal complaint compared to non-isolated individuals - Those on isolation precautions for respiratory illnesses stayed 17 % longer (LOS, 8.5 days vs. 7.6 days; 95 % CI: 1.09, 1.12), stayed 9 % longer than expected, (LOS/ELOS, 1.08 vs. 1.01; 95 % CI: 1.03, 1.15), and had 23 % higher cost of care (direct cost, CAD $7194 vs. CAD $6294; 95 % CI: 1.14, 1.32) than non-isolated individuals. - Patients isolated for MRSA were 4.4 % more likely than non-isolated individuals to be readmitted within 30 days after discharge (rate, 19.0 % vs. 14.7 %; 95 % CI: 1.4 %, 7.3 %). There were no significant differences in 30-day ED visits, formal complaints, or inpatient mortality rates between the cohorts - Patients isolated for MRSA stayed 30 % longer (LOS, 11.9 days vs. 9.1 days; 95 % CI: 1.22, 1.39), stayed 13 % longer than expected, (LOS/ELOS, 1.3 vs. 1.2; 95 % CI: 1.07, 1.20), and had 43 % higher cost of care (direct cost, CAD $11,009 vs. CAD $7670; 95 % CI: 1.33, 1.54) compared to matched controls	Included in Berry et al., 2020

Reference	Study type	Population	Intervention (PPE, isolation, masking, etc.)	Findings	Notes
Wassenberg, Severs & Bonten, 2010	Cross-sectional matched cohort study	Patients with antibiotic-resistant bacterial infection (n= 42) + matched controls (n= 84)	Short-term isolation	- Isolated and control patients had comparable median HADS, HADS-A, HADS-D (anxiety and depression) and EQ-VAS (health outcomes) scores - Patients who had been in isolation for 48 h had higher VAS scores than those isolated for 24 h (70 vs 60, P=0.02) - Length of hospital stay [24 h vs 48 h or <1 week vs >1 week (not shown)] was not associated with different HADS and EQ VAS scores in both patient groups - No association between being in isolation, age, gender, level of education, admitting specialty and duration of hospitalisation prior to inclusion and EQ VAS score could be demonstrated. - All isolated patients included answered the isolation evaluation questionnaire and reported their experience with isolation measures with a median VAS rating of 62.5 [interquartile range (IQR) 46.9–75.0]. Most patients had positive associations with infection control measures - no differences were demonstrated in levels of anxiety and depression between short-term-isolated and non-isolated patients, nor were there apparent differences in self rated quality of life. Patients treated in isolation had a positive attitude towards the infection prevention precautions	- May not be generalizable as “short-term isolation” is not applicable to COVID hospitalization
Yánez Benítez et al., 2020	Cross-sectional survey	Surgeons across 26 countries (n= 134)	83% reported double and 7% triple gloving; for eye protection, 31% used goggles, 30% facemask, 30% used both, and 9% a surgical face shield	- Over half of the respondents (54%) said that they felt their surgical performance during the outbreak was compromised by PPE use - 54% reported communication issues, 63% experienced visual interference, and 18% reported situational awareness concern - 66% expressed a decrease in overall comfort, 82% reported an increase in surgical fatigue, and 48% agreed that using PPE influenced their decision-making process	- Potential for sampling bias and recall bias

Reference	Study type	Population	Intervention (PPE, isolation, masking, etc.)	Findings	Notes
Yin et al., 2013	Quasi-experimental Retrospective cohort study	Patients admitted to pediatric service in Iowa (n= 363782 patient days)	Mandatory universal gloving	- During RSV season, all health care workers in the pediatric units must wear a new pair of gloves every time they see a patient. They must remove the gloves and perform hand hygiene before leaving the patient's room - During the study period, 54.2% of the months were in mandatory gloving periods and 45.8% were in standard care periods. - Universal gloving reduced the rates of HAIs in any pediatric unit by 25% (relative risk [RR]: 0.75; 95% confidence interval [CI]: 0.69–0.93; P = .010), after adjusting for long-term time trends, seasonality, and the effect of HAP and VAP surveillance - Glove use was associated with significantly lower HAI rates in the PICU (RR: 0.63; 95% CI: 0.42–0.93; P = .021), NICU (RR: 0.62; 95% CI: 0.39–0.98; P = .043), and PBMTU (RR: 0.52; 95% CI: 0.29–0.91; P = .022), but not in the PHOSCU (RR: 1.36; 95% CI: 0.86–2.16; P = .189) and PMSMAU (RR: 0.86; 95% CI:0.49–1.52; P = 0.607) - Universal gloving significantly reduced the risk of bloodstream infections (BSI) (RR: 0.63; 95% CI: 0.49–0.81; P= .001) and CLABSI (RR: 0.61; 95% CI: 0.44–0.84; P = .003). - No significance differences were found for pneumonias (HAP, VAP) and C. difficile infections - Unmonitored inappropriate glove use may increase the risk of MRSA transmission	

Methods

Question 1: Can the prevalence of COVID-19 in the community be used to predict the likelihood of healthcare-based outbreaks?

Statistical Analysis of AHS Data for Acute Care

Modeling the association of outbreaks in hospitals with COVID_19 case prevalence in Alberta

- Prepared for the Scientific Advisory Group
- Prepared by Shihe Fan, Edmonton Zone Analytics and Reporting, Analytics (DIMR)
- Prepared on: Nov 27, 2020
- Contact info: shihe.fan@ahs.ca

Original analytical question asked:

"Can the prevalence of COVID-19 in the community be used to predict the likelihood of healthcare based outbreaks?"

In this analysis, however, no attempt was made to develop a predictive model for future outcomes. It only examined the association of hospital outbreaks with COVID-19 case prevalence in the province in data collected during the period from Mar 15 to Nov 21, 2020.

Data sources used in this analysis:

AHSDRRX.world (DIMR data repository)

1. AB_POP_HLTH_STATS_RPT. POP_HLTH (Population data by postal code location)
2. AHSDATA. DIM_DEL_SITE (Hospitals and their geographic location)
3. COVID_19.AH_COVID_19_PHNS_DETAIL (COVID_19 cases) (For cases and sources of infection)
4. COVID_19.AB_COVID_MASTER_PT_REGISTRY (For identifying incidence and active cases)
5. COVID_19. CDOM_COVID_19_OUTBREAKSUMMARY (Summary of all outbreaks)
6. COVID_19. PROV_LAB_VERIFIED_RESULTS_V2 (For lab positive test rates)
7. AHSDATA.PROVINCIAL REGISTRY (Demographics)

Data description and variable consideration:

Table 1 lists the total number of outbreaks per AHS zones, and **Figure 1** shows the breakdown of the outbreaks by zone and week, starting from Mar 15, 2020 as the first week until Nov 21, 2020.

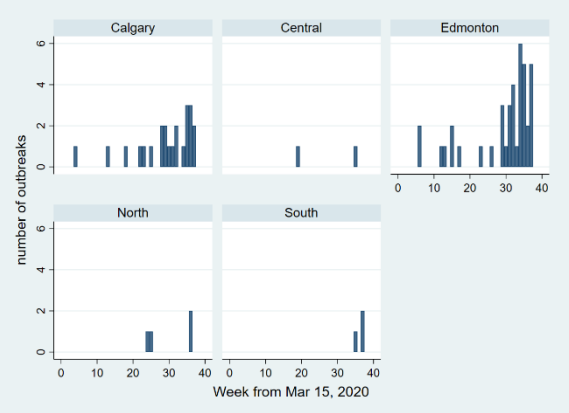
Table 1. Number of hospital outbreaks declared during the period from Mar 15 to Nov 21, 2020

Zone	South	Calgary	Central	Edmonton	North
Outbreaks	3	23	3	39	4

The outbreak numbers per week in each AHS zone is highly skewed with inflated number of zeros. The variance of the data is therefore much larger than the mean and over-dispersion is evident as shown in **Figure 2** and confirmed by the model in **Picture 1** (alpha is statistically different from zero).

The incidence rates generally increased in recent weeks across all zones (**Figure 1**). The correlation coefficient of incidence rate with active case rate is 0.949; with lab positive rate 0.8205; with percentage of cases of unknown infection sources 0.5612. All these highly correlated variables are not used in the model. All rate calculations included cases involved in outbreaks as suggested.

Figure 1. Hospital outbreaks (left panel) and COVID-19 incidence rates (right panel) by zone by week from Mar 15 to Nov 21, 2020



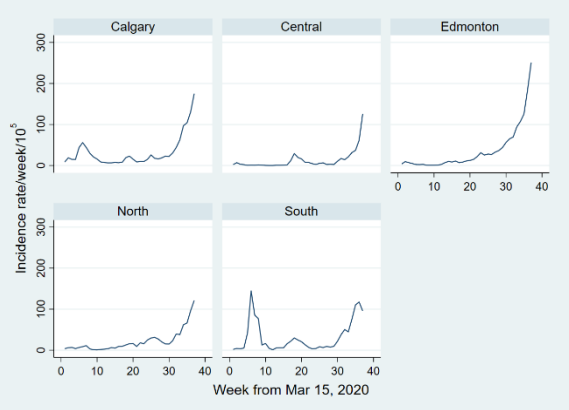
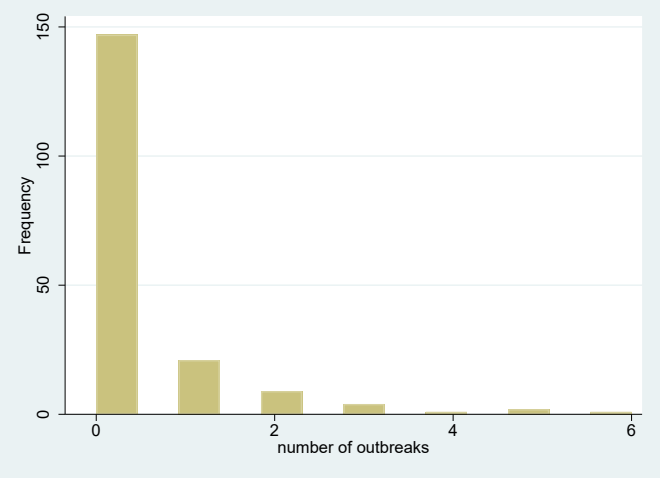


Figure 2. Frequency distribution of weekly hospital outbreaks



The case time variable is constructed from the earliest of symptom onset date, specimen collection date, or lab report date in the data sources described above. The outbreak date is constructed from the first case date.

Some records do not have geographic information attached (i.e. postal code, zone, or health region). Therefore, they cannot be assigned to any geographic zone. Some records do not have proper identifier. When record linking is required, they are not linkable. All these problematic records are used as much as possible. Otherwise, they are excluded from the analysis. The records used are generally those on the Alberta residents.

Data used in the analysis were only true to Nov 25, 2020 when the analytical data were last extracted. The author is informed of data delays at various levels of the operation/reporting structure. The results demonstrated below can therefore be said to be accurate only to the existing data up to that date.

Data inconsistency exists across data sources. For instance, a patient died on Nov 9, 2020, but his first onset date and specimen collection date were reported to be Nov 10. Data are cleansed and reconciled as much as possible on a best effort basis afforded. Separately, hospital outbreak definitions may also have changed over time. Certain aspects of inconsistency and deficiency may still exist in the analytic data. The author regrets its existence, if any, in light of the fact that not much of a choice was afforded to him given the tight time line and large amount of data to be dealt with.

Statistical model and (Stata) outputs:

Because the data is zero-inflated with over-dispersion, a zero-inflated negative binomial model is chosen for the analysis. The dependent variable is weekly outbreaks in acute care hospitals in each AHS zone. The independent variables are weekly incidence case rates categorized into 3 groups: < 50, 50 - <100, and ≥100 cases per week per 100,000 population, and the AHS zones. The discretization of the incidence rates is to honor the requestor's interest in knowing how outbreak pictures change in relation to different levels of incidence rates.

The data is analyzed using Stata/MP 16.1 for Windows (64-bit X86-64) (StataCorp LLC, Texas, U.S.A.). The exact Stata model code used is:

zinb outbreaks i.incid_rate_cat, inflate(i.incid_rate_cat i.zone_id) exposure(hospitals) cluster(zone_id)

The exposure variable in the model is the number of hospitals in each zone, which causes each zone to be observed in different frequencies each week. Because each zone is observed 37 weeks from Mar 15, 2020 to Nov 21, 2020, the variance estimate took this into account, with a cluster estimation method.

Picture 1 captures the model output from Stata. The outbreaks equation logically shows increases in outbreaks with the rise in weekly incidence case rates. **The inflation equation [p(outbreak=0)] shows decreased probability of no outbreaks as incidence rates increase (exponentiation of the regression coefficients will get the odds ratio of no outbreaks) .** Compared to the South Zone, the Calgary and Edmonton Zones are much less likely to see no outbreaks, whereas the Central and North Zones are not much different from the South Zone.

Picture 2 shows the estimated marginal probability of no outbreaks compared to each base level. An interesting phenomenon is when compared to the base level (<50), the highest level of incidence rates (≥100) is not as more likely as the intermediate level (50 -100) to induce hospital outbreaks. The reason here is a strong zone effect. The high rates occur most recently and primarily in the Calgary and Edmonton Zones, so the zone effect overwhelms the rate effect.

Picture 3 shows the estimated number of outbreaks per week in acute care hospitals of the province. Logically, the higher the weekly incidence rate, the higher number of outbreaks will inevitably occur in hospitals (10 x increase when incidence rates rise from <50 to ≥100 $week^{-1}10^{-5}$). This leads to a conclusion that either hospital infection prevention & control programs must step up efforts to prevent hospital outbreaks or efforts must be made to suppress the incidence cases in the community at large.

All said, the author must reiterate that the original question could be investigated in many different ways from different angles with different perspectives. The analysis nevertheless is done in the spirit of conciseness and simplicity to meet the immediate need for information of the Scientific Advisory Group.

Picture 1. Model output

```
Zero-inflated negative binomial regression      Number of obs     =        185
                                                Nonzero obs       =         38
                                                Zero obs          =        147

Inflation model      = logit                    Wald chi2(2)      =          .
Log pseudolikelihood = -109.3833                Prob > chi2       =          .

                                  (Std. Err. adjusted for 5 clusters in zone_id)
------------------------------------------------------------------------------
             |               Robust
   outbreaks |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
outbreaks    |
incid_rate_cat |
      50-100 |   1.185588   .4706569     2.52   0.012     .2631172    2.108058
       >=100 |   2.142998   .2757162     7.77   0.000     1.602604    2.683392
             |
       _cons |  -3.733244   .0990909   -37.67   0.000    -3.927458   -3.539029
ln(hospitals)|          1  (exposure)
-------------+----------------------------------------------------------------
inflate      |
incid_rate_cat |
      50-100 |  -1.512862   .6019129    -2.51   0.012     -2.69259   -.3331343
       >=100 |  -1.229241   1.218191    -1.01   0.313    -3.616851    1.158369
             |
      zone_id |
           2 |  -17.66215   4.394478    -4.02   0.000    -26.27516   -9.049129
           3 |  -.2805183   .3525175    -0.80   0.426    -.9714399    .4104034
           4 |   -18.8388   1.565712   -12.03   0.000    -21.90754   -15.77007
           5 |  -.4864621   .3025259    -1.61   0.108    -1.079402    .1064777
             |
       _cons |   2.758901   .5311262     5.19   0.000     1.717913    3.799889
-------------+----------------------------------------------------------------
     /lnalpha |  -2.181521    .952395    -2.29   0.022    -4.048181   -.3148609
-------------+----------------------------------------------------------------
        alpha |   .1128697   .1074966                      .0174541    .7298904
------------------------------------------------------------------------------
```

Note: because the model parameters are more than the clusters, the model χ^2 is not produced.

Picture 2. Marginal changes in probability of zero outbreaks from the base level

```
. margins, dydx(i.incid_rate_cat i.zone_id ) predict(pr)

Average marginal effects                        Number of obs     =        185
Model VCE    : Robust

Expression   : Pr(outbreaks=0), predict(pr)
dy/dx w.r.t. : 2.incid_rate_cat 3.incid_rate_cat 2.zone_id 3.zone_id 4.zone_id 5.zone_id
```

	dy/dx	Delta-method Std. Err.	z	P>|z|	[95% Conf.	Interval]
incid_rate_cat						
50-100	-.1174989	.0509449	-2.31	0.021	-.217349	-.0176487
>=100	-.0862042	.1072379	-0.80	0.421	-.2963866	.1239781
zone_id						
2	-.9185635	.0193898	-47.37	0.000	-.9565667	-.8805603
3	-.0225445	.0257107	-0.88	0.381	-.0729365	.0278476
4	-.9185637	.0193905	-47.37	0.000	-.9565683	-.880559
5	-.0423203	.0204495	-2.07	0.038	-.0824005	-.0022401

Note: dy/dx for factor levels is the discrete change from the base level.

Picture 3. Number of outbreaks per week predicted if they do occur

```
. margins i.incid_rate_cat

Predictive margins                              Number of obs     =        185
Model VCE    : Robust

Expression   : Predicted number of events, predict()
```

	Margin	Delta-method Std. Err.	z	P>|z|	[95% Conf.	Interval]
incid_rate_cat						
<50	.1947406	.0163514	11.91	0.000	.1626924	.2267888
50-100	.9414505	.4415908	2.13	0.033	.0759485	1.806953
>=100	2.242825	.793729	2.83	0.005	.6871449	3.798505

Statistical Analysis of AHS Data for Long Term Care

Modeling the association of outbreaks in long-term care facilities with COVID_19 case prevalence in Alberta

- Prepared for the Scientific Advisory Group
- Prepared by Shihe Fan, Edmonton Zone Analytics and Reporting, Analytics (DIMR)
- Prepared on: Nov 28, 2020
- Contact info: shihe.fan@ahs.ca

Original analytical question asked:

"Can the prevalence of COVID-19 in the community be used to predict the likelihood of healthcare based outbreaks?"

Similar to the previous analysis, this analysis examined only the association of LTC outbreaks with COVID-19 case prevalence in the province in data collected from Mar 15 to Nov 21, 2020.

Data sources used in this analysis:

AHSDRRX.world (DIMR data repository)

8. AB_POP_HLTH_STATS_RPT. POP_HLTH (Population data by postal code location)
9. COVID_19.AH_COVID_19_PHNS_DETAIL (COVID_19 cases) (For cases and sources of infection)
10. COVID_19.AB_COVID_MASTER_PT_REGISTRY (For identifying incidence and active cases)
11. COVID_19. CDOM_COVID_19_OUTBREAKSUMMARY (Summary of all outbreaks)
12. COVID_19. PROV_LAB_VERIFIED_RESULTS_V2 (For lab positive test rates)
13. AHSDATA.PROVINCIAL REGISTRY (Demographics)
14. Long-term care facility (LTC) list provided by Public Health

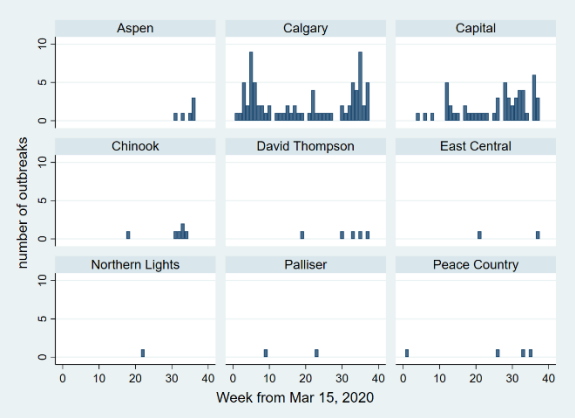
Data description and variable consideration:

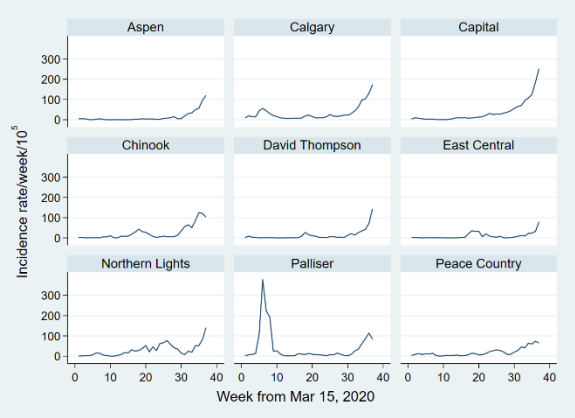
Table 1 lists the total number of outbreaks per former AHS regional health authority (RHA), and **Figure 1** shows the breakdown of the outbreaks and incidence rates by RHA and week starting from Mar 15, 2020 as the first week until Nov 21, 2020. **Figure 2** shows the relationship between weekly LTC outbreaks and incidence rates.

Table 1. Number of LTC outbreaks declared during the period from Mar 15 to Nov 21, 2020

RHA code	Health Region	Outbreaks
1	Chinook	6
2	Palliser	2
3	Calgary	80
4	David Thompson	5
5	East Central	2
6	Capital	55
7	Aspen	6
8	Peace Country	4
9	Northern Lights	1

Figure 1. LTC outbreaks (left panel) and COVID-19 incidence rates (right panel) by RHA by week from Mar 15 to Nov 21, 2020





Not increasing proportionally in the 2nd wave, even though seeing a bimodal peak. (measures in place at LTC), first wave they were not ready.

Figure 2. Relationship between weekly outbreaks in LTCs & COVID-19 incidence rates

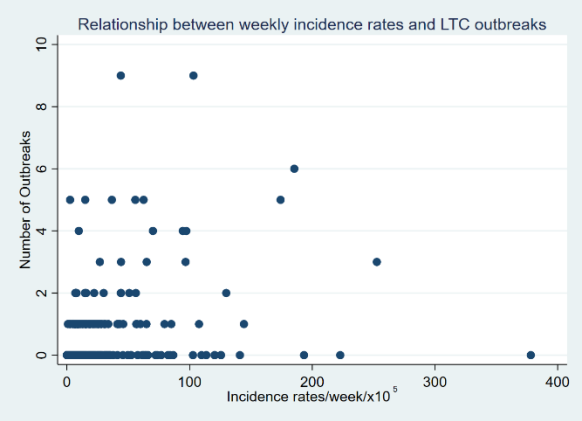
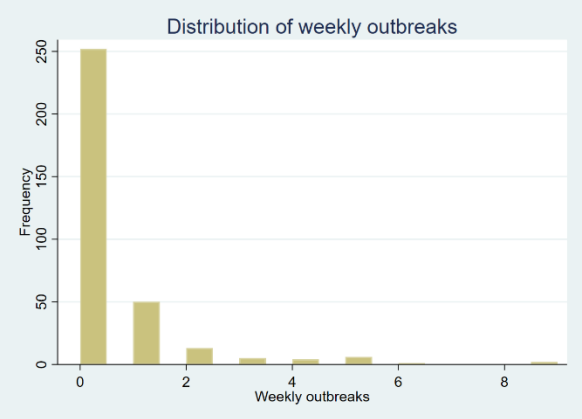


Figure 3. Frequency distribution of weekly LTC outbreaks



The outbreak numbers per week in each RHA is highly skewed with inflated number of zeros (see **Figure 3),** causing the data being over-dispersed with variance much larger than the mean (**Figure 3** and statistically significant alpha from zero in **Picture 1**).

The incidence rates generally increased in recent weeks across all RHAs (**Figure 1**). The correlation coefficient of incidence rate with active case rate is 0.8765 and with lab positive rate 0.8324. All these highly correlated variables are not used in the model. The percentage of cases with unknown infection sources is not calculatable due to the lack of information on RHA coding in the source data. All rate calculations included cases involved in outbreaks as suggested.

The case time variable is constructed from the earliest of symptom onset date, specimen collection date, or lab report date in the data sources described above. The outbreak date is constructed from the first case date.

Some records do not have geographic information attached (i.e. postal code or RHA). Therefore, they cannot be assigned to any RHA. Some records do not have proper identifier. When record linking is required, they are not linkable. All these problematic records are used as much as possible. Otherwise, they are excluded from the analysis. The records used are generally those on the Alberta residents.

Data used in the analysis were only true to Nov 25, 2020 when the analytical data were last extracted. The author is informed of data delays at various levels of the operation/reporting structure. The results demonstrated below can therefore be said to be accurate only to the existing data up to that date.

Data inconsistency exists across data sources. For instance, a patient died on Nov 9, 2020, but his first onset date and specimen collection date were reported to be Nov 10. Data are cleansed and reconciled as much as possible on a best effort basis afforded. Separately, LTC outbreak definitions may also have changed over time. Certain aspects of inconsistency and deficiency may still exist in the analytic data. The author regrets its existence, if any, in light of the fact that not much of a choice was afforded to him given the tight time line and large amount of data to be dealt with.

Statistical model and (Stata) outputs:

Because the data is zero-inflated with over-dispersion, a zero-inflated negative binomial model is chosen for the analysis. This model simultaneously models two data generation processes, a zero generation process and a random zero from the Poisson process. The dependent variable is weekly outbreaks in LTCs in each RHA. The independent variables are weekly incidence case rates categorized into 3 groups: < 50, 50 - <100, and ≥100 cases per week per 100,000 population, and the RHAs. The discretization of the incidence rates is again to honor the requestor's interest in knowing how outbreak pictures change in relation to different levels of incidence rates.

The data is analyzed using Stata/MP 16.1 for Windows (64-bit X86-64) (StataCorp LLC, Texas, U.S.A.). The exact Stata model code used is:

zinb outbreaks i.incid_rate_cat, inflate(i.incid_rate_cat i.rha_id) exposure(ltcs) cluster(rha_id)

The exposure variable in the model is the number of LTCs in each RHA, which causes each RHA to be observed in different frequencies each week. Because each RHA is observed 37 weeks from Mar 15, 2020 to Nov 21, 2020, a cluster estimation method is used to calculate variance.

Picture 1 captures the model output from Stata. The outbreaks equation logically shows increases in outbreaks with the rise in weekly incidence case rates. The inflation equation [p(outbreak=0)] shows decreased probability of no outbreaks when incidence rates increase from <50 to between 50 - <100 week$^{-1}10^{-5}$ and then not much a difference with incidence rates rising further above the 100 week$^{-1}10^{-5}$ level (exponentiating the regression coefficients will get the odds ratio of no outbreaks). Compared to the Chinook RHA, all other RHAs, except the East Central (5) RHA, are much less likely to see no outbreaks. The Chinook and East Central RHA are not much different.

Picture 2 shows the estimated marginal probability of no outbreaks compared to the base level. An interesting phenomenon again is when compared to the base level (<50), the highest level of incidence rates (≥100) is not as more likely as the intermediate level (50 -100) to induce LTC outbreaks. This is revealed in **Figure 2**. Similar to what was seen in the hospital outbreak analysis, the RHA effect is probably dominated the incidence rate effect more because both the Calgary and Edmonton RHA have had more outbreaks. Another reason may be the effect of prevention measures, such as visitation restriction and cross-site employment reduction, which suppressed outbreaks.

Picture 3 shows the estimated number of outbreaks per week in LTCs of the province. As consistently seen in **Figure 2**, the intermediate incidence rate level (50 - 100 week$^{-1}10^{-5}$) induced more outbreaks than the higher level (≥100 week$^{-1}10^{-5}$). Nevertheless, both are still significantly higher than the base level (<50 week$^{-1}10^{-5}$). Therefore, it is necessary to enhance infection prevention & control programs to prevent LTC outbreaks as incidence case rates increase in the community at large.

All said, the author repeats that the original question was investigated in the spirit of conciseness and simplicity to meet the immediate need for information of the Scientific Advisory Group.

Picture 1. Model output

```
Zero-inflated negative binomial regression      Number of obs     =        333
                                                Nonzero obs       =         81
                                                Zero obs          =        252

Inflation model      = logit                    Wald chi2(2)      =          .
Log pseudolikelihood = -197.5411                Prob > chi2       =          .

                                  (Std. Err. adjusted for 9 clusters in rha_id)
------------------------------------------------------------------------------
             |               Robust
  outbreaks  |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
outbreaks    |
incid_rate_cat |
      50-100 |   .9217217   .1265443     7.28   0.000     .6736995    1.169744
       >=100 |    1.02495   .1026419     9.99   0.000     .8237756    1.226125
             |
       _cons |  -4.56734   .1391278   -32.83   0.000    -4.840025   -4.294655
    ln(LTCS) |          1  (exposure)
-------------+----------------------------------------------------------------
inflate      |
incid_rate_cat |
      50-100 |  -26.23239   .8820701   -29.74   0.000    -27.96121   -24.50356
       >=100 |   .2667177   .8901665     0.30   0.764    -1.477977    2.011412
             |
       rha_id |
           2 |  -1.247194   .0870748   -14.32   0.000    -1.417858    -1.07653
           3 |  -25.81283   1.080365   -23.89   0.000    -27.93031   -23.69536
           4 |  -1.657514   .0551944   -30.03   0.000    -1.765693   -1.549335
           5 |   .0544458   .1255537     0.43   0.665     -.191635    .3005265
           6 |  -3.700529    .183146   -20.21   0.000    -4.059489    -3.34157
           7 |  -.7292994   .0831096    -8.78   0.000    -.8921912   -.5664077
           8 |  -2.327252   .1825253   -12.75   0.000    -2.684995   -1.969508
           9 |  -2.332751   .1993704   -11.70   0.000     -2.72351   -1.941993
             |
       _cons |   2.170944   .1859938    11.67   0.000     1.806403    2.535485
-------------+----------------------------------------------------------------
     /lnalpha |  -2.047477   .2179617    -9.39   0.000    -2.474674    -1.62028
-------------+----------------------------------------------------------------
        alpha |   .1290602   .0281302                     .0841905    .1978434
------------------------------------------------------------------------------
```

Note: because the model parameters are more than the clusters, the model χ^2 is not produced.

Picture 2. Marginal changes in probability of zero outbreaks from the base level

```
.  margins, dydx(i.incid_rate_cat i.rha_id ) predict(pr)

Average marginal effects                        Number of obs     =        333
Model VCE    : Robust

Expression   : Pr(outbreaks=0), predict(pr)
dy/dx w.r.t. : 2.incid_rate_cat 3.incid_rate_cat 2.rha_id 3.rha_id 4.rha_id 5.rha_id 6.rha_id 7.rha_id 8.rha_id
               9.rha_id
```

	Delta-method					
	dy/dx	Std. Err.	z	P>|z|	[95% Conf.	Interval]
incid_rate_cat						
50-100	-.5609927	.036562	-15.34	0.000	-.632653	-.4893325
>=100	.0408584	.132849	0.31	0.758	-.2195208	.3012376
rha_id						
2	-.1638592	.0312167	-5.25	0.000	-.2250428	-.1026757
3	-.8179356	.0130859	-62.51	0.000	-.8435834	-.7922878
4	-.2454378	.0253134	-9.70	0.000	-.2950513	-.1958244
5	.0044034	.0102689	0.43	0.668	-.0157233	.0245301
6	-.6536289	.0309889	-21.09	0.000	-.714366	-.5928918
7	-.0800337	.0110413	-7.25	0.000	-.1016743	-.0583931
8	-.3948664	.05279	-7.48	0.000	-.4983328	-.2914
9	-.3961099	.0585959	-6.76	0.000	-.5109558	-.2812639

```
Note: dy/dx for factor levels is the discrete change from the base level.
```

Picture 3. Number of outbreaks per week predicted if they do occur

```
.  margins i.incid_rate_cat
numerical derivatives are approximate
flat or discontinuous region encountered

Predictive margins                              Number of obs     =        333
Model VCE    : Robust

Expression   : Predicted number of events, predict()
```

	Delta-method					
	Margin	Std. Err.	z	P>|z|	[95% Conf.	Interval]
incid_rate_cat						
<50	.3491688	.0362762	9.63	0.000	.2780687	.4202688
50-100	1.360374	.2297694	5.92	0.000	.9100346	1.810714
>=100	.9269328	.2177099	4.26	0.000	.5002291	1.353636

Literature Search

A search of the primary literature was conducted by Rachel Zhou from Knowledge Resources Services (KRS) within the Knowledge Management Department of Alberta Health Services. KRS searched in OVID MEDLINE, PubMed, TRIP PRO, CADTH, Oxford Centre for Evidence-Based Medicine, MedRxiv, bioRxiv, Google and Google Scholar. Citation tracking was also used in Google Scholar.In addition, google searching was also

performed by the writer. Briefly, the search strategy involved combinations of keywords for SARS-CoV-2; incidence/prevalence, disease transmission, outbreaks, and healthcare settings. Searches were limited to English and publications in 2020.

References identified by KRS in their search were initially screened and the inclusion/exclusion criteria listed in Table 8 below. There were 1612 citations identified by the initial search and screened. An additional 26 references were identified from a rapid review by the McMaster National Collaborating Centre for Methods and Tools (NCCMT) and an additional 2 by ad hoc searching. A total of 1640 references were reviewed and 1621 were excluded in accordance with the inclusion/exclusion criteria stated below. A total of 19 primary studies (n=16 applicable to LTC; n=3 in acute care settings) and were included in the narrative synthesis. The PRISMA diagram (Moher et al., 2009) is included below as Figure 3.

Table 8. Inclusion and exclusion criteria for results of the literature search

Inclusion Criteria	Exclusion Criteria
- Primary studies, rapid reviews, systematic reviews, guidelines - COVID_19 specific studies - Acute care and/or long-term care settings - Community transmission role in outbreaks - English language only - 2020 publications	- Commentaries, opinion pieces, editorials - Publications before 2020 - No description of community transmission role in outbreaks

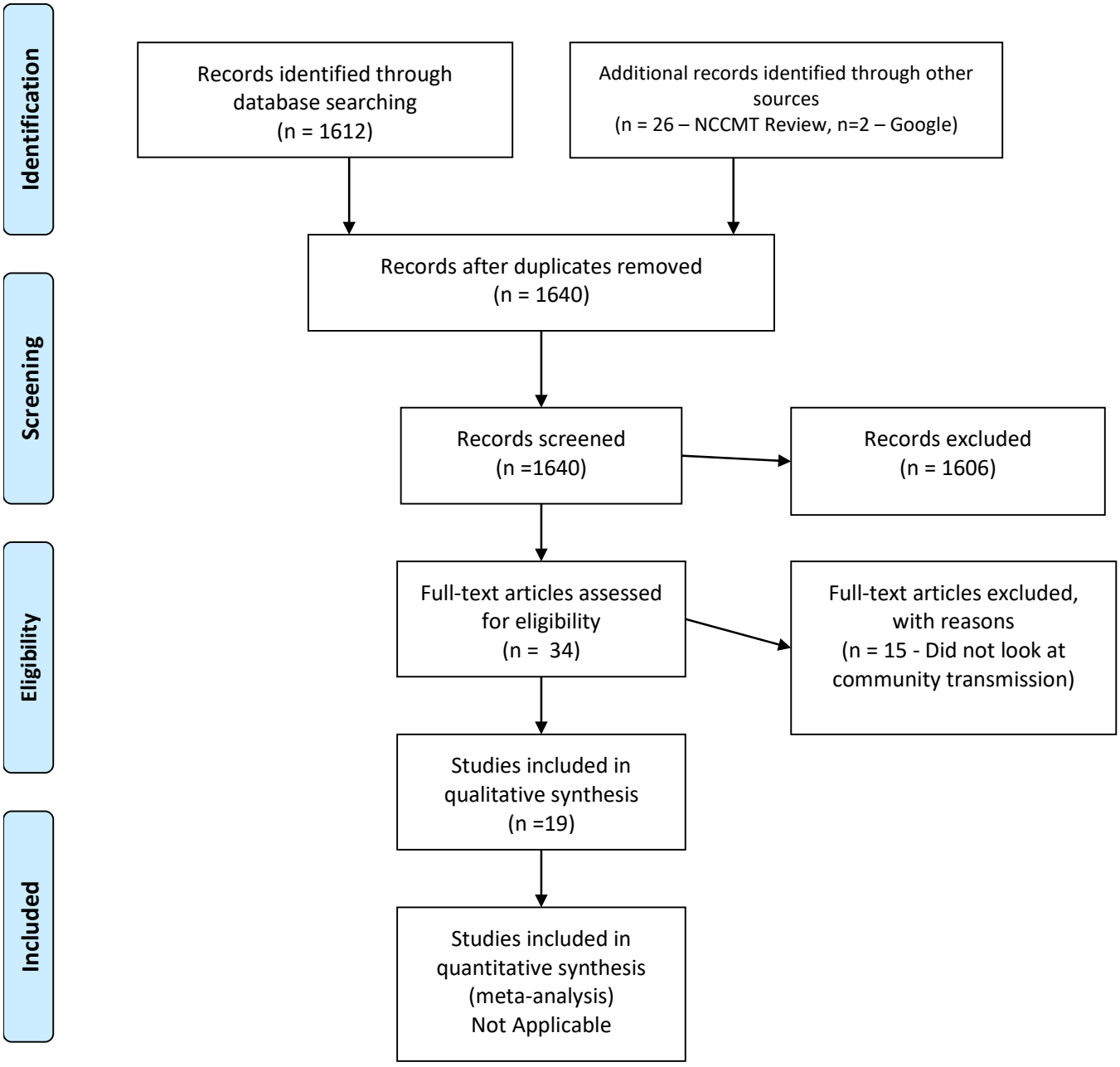


Figure 3. PRISMA diagram for studies relevant to Question 1.

Search Strategy for Question 1

Ovid MEDLINE(R) and Epub Ahead of Print, In-Process & Other Non-Indexed Citations, Daily and Versions(R) 1946 to November 17, 2020

#	Searches	Results
1	exp Coronavirus/ or Coronavirus Infections/ or (coronaviru* or corona viru* or ncov* or n-cov* or novel cov* or COVID-19 or COVID19 or COVID-2019 or COVID2019 or SARS-CoV-2 or SARSCoV-2 or SARSCoV2 or SARSCoV19 or SARS-Cov-19 or SARSCov-19 or SARSCoV2019 or SARS-Cov-2019 or SARSCov-2019 or severe acute respiratory syndrome coronaviru* or severe acute respiratory syndrome cov 2 or 2019 ncov or 2019ncov).kf,tw.	91376
2	Incidence/ or Prevalence/	539962
3	exp Disease Transmission, Infectious/	71036
4	(prevalence or incidence or transmit* or transmission* or case or cases or thousand or "1000" or "1,000").kf,tw.	5150960
5	or/2-4	5313675
6	(communit* or public).kf,tw.	1007317
7	exp Disease Outbreaks/	131962
8	(outbreak* or cluster* or surge*).kf,tw.	1875253
9	7 or 8	1954520
10	exp academic medical centers/ or exp ambulatory care facilities/ or exp hospitals/ or exp residential facilities/	413867
11	exp Hospital Units/	113865
12	Emergency Service, Hospital/	70690
13	(hospital or hospitals or long term care or nursing home* or acute care or hospital unit* or clinical observation unit* or delivery room* or h?emodialysis unit* or intensive care unit* or burn units* or coronary care unit* or intensive care unit* or recovery room* or respiratory care unit* or nursing station* or operating room* or self-care unit* or ER or ED or emergency department*).kf,tw.	1490219
14	or/10-13	1740731
15	1 and 5 and 6 and 9 and 14	906
16	limit 15 to (english language and yr="2020 -Current" and covid-19)	797

PubMed

(((((((wuhan[tw] AND (coronavirus[tw] OR corona virus[tw])) OR coronavirus*[ti] OR COVID*[tw] OR nCov[tw] OR 2019 ncov[tw] OR novel coronavirus[tw] OR novel corona virus[tw] OR covid-19[tw] OR SARS-COV-2[tw] OR Severe Acute Respiratory Syndrome Coronavirus 2[tw] OR coronavirus disease 2019[tw] OR corona virus disease 2019[tw] OR new coronavirus[tw] OR new corona virus[tw] OR new coronaviruses[all] OR novel coronaviruses[all] OR "Severe Acute Respiratory Syndrome Coronavirus 2"[nm] OR 2019 ncov[tw] OR nCov 2019[tw] OR SARS Coronavirus 2[all]) AND (2019/12[dp]:2020[dp])) AND ((((("incidence"[MeSH Terms]) OR ("prevalence"[MeSH Terms])) OR ("disease transmission, infectious"[MeSH Terms])) OR (prevalence[Title/Abstract] OR incidence[Title/Abstract] OR transmit*[Title/Abstract] OR transmission*[Title/Abstract] OR case[Title/Abstract] OR cases[Title/Abstract] OR thousand[Title/Abstract] OR "1000"[Title/Abstract] OR "1,000"[Title/Abstract]))) AND (((((("academic medical centers"[MeSH Terms]) OR ("ambulatory care facilities"[MeSH Terms])) OR ("hospital units"[MeSH Terms])) OR ("hospitals"[MeSH Terms])) OR ("residential facilities"[MeSH Terms])) OR ("emergency service, hospital"[MeSH Terms])) OR (hospital[Title/Abstract] OR hospitals[Title/Abstract] OR long term care[Title/Abstract] OR nursing home*[Title/Abstract] OR acute care[Title/Abstract] OR hospital unit*[Title/Abstract] OR clinical observation unit*[Title/Abstract] OR delivery room*[Title/Abstract] OR h?emodialysis unit*[Title/Abstract] OR intensive care unit*[Title/Abstract] OR burn units*[Title/Abstract] OR coronary care unit*[Title/Abstract] OR intensive care unit*[Title/Abstract] OR recovery room*[Title/Abstract] OR respiratory care unit*[Title/Abstract] OR nursing station*[Title/Abstract] OR operating room*[Title/Abstract] OR self-care unit*[Title/Abstract] OR ER[Title/Abstract] OR ED[Title/Abstract] OR emergency department*[Title/Abstract]))) AND (communit*[Title/Abstract] OR public[Title/Abstract])) AND (("disease outbreaks"[MeSH Terms]) OR (outbreak*[Title/Abstract] OR cluster*[Title/Abstract] OR surge*[Title/Abstract]))) AND (("2020/01/01"[Date - Publication] : "3000"[Date - Publication]))) AND ("english"[Language])

TRIP Pro

(coronaviru* or corona viru* or ncov* or n-cov* or novel cov* or COVID-19 or COVID19 or COVID-2019 or COVID2019 or SARS-CoV-2 or SARSCoV-2 or SARSCoV2 or SARSCoV19 or SARS-Cov-19 or SARSCov-19 or SARSCoV2019 or SARS-Cov-2019 or SARSCov-2019 or severe acute respiratory syndrome coronaviru* or severe acute respiratory syndrome cov 2 or 2019 ncov or 2019ncov) AND (prevalence or incidence or transmit* or transmission* or case or cases or thousand or "1000" or "1,000") AND (communit* or public) AND (outbreak* or cluster* or surge*) AND (hospital or hospitals or long term care or nursing home* or acute care or hospital unit* or clinical observation unit* or delivery room* or h?emodialysis unit* or intensive care unit* or burn units* or coronary care unit* or intensive care unit* or recovery room* or respiratory care unit* or nursing station* or operating room* or self-care unit* or ER or ED or emergency department*) from:2020

718 retrieved

medRxiv & bioRxiv

Search terms: COVID community prevalence hospital health care workers outbreak

Limits: posted between "01 Jan, 2020 and 18 Nov, 2020"

Google / Google Scholar

COVID community prevalence impact hospital outbreak

Question 2: What guidelines do other jurisdictions use to determine PPE requirements? Are there common features to these guidelines?

Literature Search

A search of the grey literature was conducted by Rachel Zhou from Knowledge Resources Services (KRS) within the Knowledge Management Department of Alberta Health Services. KRS searched websites of: Canadian provincial and territorial governments, health systems, or authorities, international governments (or ministries of health); and national and international and public health and health protection agencies. In addition, google searching was also performed. Briefly, the search strategy involved combinations of keywords for SARS-CoV-2; COVID-19 and PPE guidelines.

References identified by KRS in their search were initially screened and the inclusion/exclusion criteria listed in Table 9 below. Fifty-seven references were identified by KRS with titles and website links provided for further review. An additional 12 references were identified from ad hoc searching. A total of 69 references were reviewed and 42 were excluded in accordance with the inclusion/exclusion criteria stated below. A total of 27 guidelines, guidance documents, technical reports, and/or frameworks of relevance to this question were identified (n=18 applicable to HCWs in either acute care or any healthcare setting; n=9 specific to HCWs in LTC settings) and were included in the narrative synthesis.

Table 9. Inclusion and exclusion criteria for results of the literature search

Inclusion Criteria	Exclusion Criteria
- Grey literature: guidelines, guidance documents, reports, briefs providing guidance on PPE for healthcare workers during the COVID-19 pandemic - Date of guidance: January 1 2020-present (in order to capture those relevant to the COVID-19 pandemic) - Acute care and/or long-term care settings - Any Canadian or international jurisdiction outside of Alberta - English language only	- Published peer-reviewed literature - Commentaries, opinion pieces, editorials, or narrative literature reviews - Guidelines published before 2020 (not likely to be specific to COVID-19 precautions) - No explicit description of specific PPE requirements (and in which care situations)

Question 3. What degree of protection is offered from universal masking in healthcare, including evidence for the utility of medical masks in preventing transmission from an infected person (source control)??

Literature Search

A literature search was conducted by Rachel Zhou from Knowledge Resources Services (KRS) within the Knowledge Management Department of Alberta Health Services. KRS searched databases for reviews published from January 1, 2020 to present, and included: OVID MEDLINE, PubMed, TRIP PRO, CADTH, Oxford Centre for Evidence-Based Medicine, MedRxiv, bioRxiv, Google and Google Scholar. Briefly, the search strategy involved combinations of keywords and subject headings including: SARS-CoV-2; COVID-19, MERS, SARS, RSV, healthcare settings, and PPE. Searches were limited to reviews or studies that incorporated 'reviews' of the literature on this topic and limited to English literature.

Articles identified by KRS in their search were initially screened by title and abstract against the inclusion/exclusion criteria listed in Table 10 below. Eight-hundred and seventy-nine articles were identified by KRS with references and abstracts provided for further review. An additional 49 aritcles were identified from hand-searching the reference lists of 3 relevant systematic reviews and 1 living rapid review. A total of 924 articles underwent abstract review and of these, 76 were reviewed in full-text. Ultimately, 54 were excluded from the review in accordance with the inclusion/exclusion criteria stated below. A total of 22 articles were included in the narrative synthesis. The PRISMA flow diagram for this rapid review is provided in Figure XX.

Table 10. Inclusion and exclusion criteria for results of the literature search

Inclusion Criteria	Exclusion Criteria
- Original research - peer reviewed or pre-print. - Date of research: January 1 2020-present to capture articles relevant to the COVID-19 pandemic - Participants: healthcare workers and hospitalized patients Exposure/comparator: **healthcare workers** wearing any modified or standard PPE (masks, eye protection, gloves, gowns, respirators) or Hospitalized **patients** wearing any modified or standard PPE (masks, eye protection, gloves, gowns, respirators) - Outcome: transmission of COVID-19/RSV, SARS, MERS-CoV, Influenza from HCW-to-patient, patient-to-patient, or patient-to-HCW. - Designs of interest: systematic reviews, narrative reviews, scoping reviews, living reviews. - English language only	- Grey literature or article not from a credible source - Articles written as commentaries, opinion pieces, editorials - Animal studies - Individuals in the community or public, non-healthcare settings. - Studies that do not mention use of any PPE by HCW or patients. - Studies that do not report the relevant outcomes. - Any publications prior to 2020

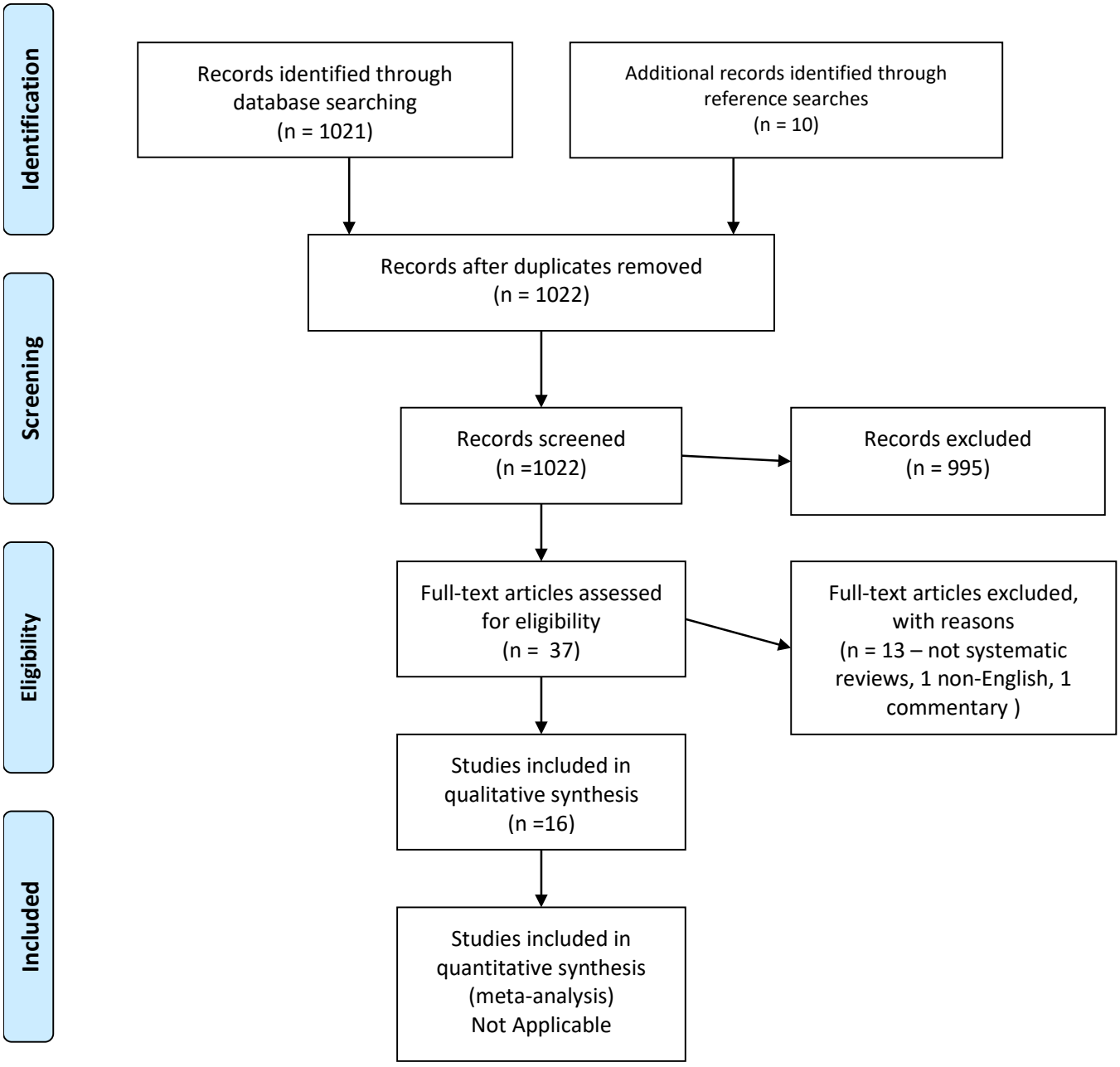


Figure 4. PRISMA flow diagram for Question 3.

Search Strategy for Question 3

Ovid MEDLINE(R) and Epub Ahead of Print, In-Process & Other Non-Indexed Citations, Daily and Versions(R) 1946 to November 19, 2020

#	Searches	Results
1	Personal Protective Equipment/ or exp masks/ or respiratory protective devices/	13440
2	(gown* or coverall* or protective layer* or surgical toga or apron* or smock or smocks or hazmat suit* or glove* or mask or masks or respiratory protective device* or KN95 or FFP2 or FFP3 or N95 or P2 or air-purifying respirator* or PAPR or "enhanced respiratory and contact precautions" or E-RCP or respiratory protection* or transparent panel* or filtering face piece* or filtering facepiece* or goggle* or visor or safety glass* or safety spectacles* or PPE or protect* equipment* or overshoe* or shoe cover* or rubber boot* or head cover* or face shield* or hood*).kf,tw.	101166
3	1 or 2	105337
4	exp Coronavirus/ or Coronavirus Infections/ or (coronaviru* or corona viru* or ncov* or n-cov* or novel cov* or COVID-19 or COVID19 or COVID-2019 or COVID2019 or SARS-CoV-2 or SARSCoV-2 or SARSCoV2 or SARSCoV19 or SARS-Cov-19 or SARSCov-19 or SARSCoV2019 or SARS-Cov-2019 or SARSCov-2019 or severe acute respiratory syndrome coronaviru* or severe acute respiratory syndrome cov 2 or 2019 ncov or 2019ncov).kf,tw.	91388
5	Middle East Respiratory Syndrome Coronavirus/	1397
6	Severe Acute Respiratory Syndrome/	5311
7	Pandemics/	41113
8	Influenza, Human/	50115
9	Respiratory Syncytial Virus Infections/	7079
10	(middle east respiratory syndrome or mers or mers-cov or severe acute respiratory syndrome or sars or sars-cov or respiratory syncytial virus infection* or rsv or influenza or pandemic*).kf,tw.	178846
11	or/4-10	225685
12	exp academic medical centers/ or exp ambulatory care facilities/ or exp hospitals/ or Inpatients/ or exp residential facilities/	431194
13	exp Hospital Units/	113898
14	Emergency Service, Hospital/	70727

15	(hospital or hospitals or long term care or nursing home* or acute care or hospital unit* or inpatient* or clinical observation unit* or delivery room* or h?emodialysis unit* or intensive care unit* or burn units* or coronary care unit* or intensive care unit* or recovery room* or respiratory care unit* or nursing station* or operating room* or self-care unit* or ER or ED or emergency department*).kf,tw.	1543311
16	exp Health Personnel/ or (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 or emergency medical technician* or health aide* or psychiatric aide* or operating room technician* or pharmacist* or physical therapist* or anatomist* or an?esthetist* or audiologist* or case manager* or endodontist* or doula* or health facility administrator* or hospital administrator* or hospital chief executive officer* infection control practitioner* or medical chaperone* or medical staff or hospitalist* or nursing or nurse or nurses or nutritionist* or occupational therapist* or physical therapist* or physician* or doctor or doctors or an?esthesiologist* or cardiologist* or dermatologist* or endocrinologist* or gastroenterologist* or geriatrician* or nephrologist* or neurologist* or oncologist* or otolaryngologist* or pathologist* or neonatologist* or physiatrist* or pulmonologist* or radiologist* or rheumatologist* or surgeon* or neurosurgeon* or ophthalm* or urologist*).kf,tw.	1797330
17	or/12-16	3190976
18	3 and 11 and 17	3070
19	limit 18 to (english language and yr="2020 -Current")	2367
20	limit 19 to "reviews (maximizes sensitivity)"	881
21	review*.mp.	3768699
22	19 and 21	574
23	20 or 22	1015

PubMed

(((((((wuhan[tw] AND (coronavirus[tw] OR corona virus[tw])) OR coronavirus*[ti] OR COVID*[tw] OR nCov[tw] OR 2019 ncov[tw] OR novel coronavirus[tw] OR novel corona virus[tw] OR covid-19[tw] OR SARS-COV-2[tw] OR Severe Acute Respiratory Syndrome Coronavirus 2[tw] OR coronavirus disease 2019[tw] OR corona virus disease 2019[tw] OR new coronavirus[tw] OR new corona virus[tw] OR new coronaviruses[all] OR novel coronaviruses[all] OR "Severe Acute Respiratory Syndrome Coronavirus 2"[nm] OR 2019 ncov[tw] OR nCov 2019[tw] OR SARS Coronavirus 2[all]) AND (2019/12[dp]:2020[dp])) AND (("health personnel"[MeSH Terms]) OR (health practitioner*[Title/Abstract] OR health professional*[Title/Abstract] OR healthcare worker*[Title/Abstract]

OR health care worker*[Title/Abstract] OR health-care worker*[Title/Abstract] OR healthcare personnel[Title/Abstract] OR health care personnel[Title/Abstract] OR health-care personnel[Title/Abstract] OR healthcare practitioner*[Title/Abstract] OR health care practitioner*[Title/Abstract] OR health-care practitioner*[Title/Abstract] OR healthcare professional*[Title/Abstract] OR health care professional*[Title/Abstract] OR health-care professional*[Title/Abstract] OR health worker*[Title/Abstract] OR health personnel[Title/Abstract] OR emergency medical technician*[Title/Abstract] OR health aide*[Title/Abstract] OR psychiatric aide*[Title/Abstract] OR operating room technician*[Title/Abstract] OR pharmacist*[Title/Abstract] OR physical therapist*[Title/Abstract] OR anatomist*[Title/Abstract] OR anesthetist*[Title/Abstract] OR anaesthetist*[Title/Abstract] OR audiologist*[Title/Abstract] OR case manager*[Title/Abstract] OR endodontist*[Title/Abstract] OR doula*[Title/Abstract] OR health facility administrator*[Title/Abstract] OR hospital administrator*[Title/Abstract] OR hospital chief executive officer* infection control practitioner*[Title/Abstract] OR medical chaperone*[Title/Abstract] OR medical staff[Title/Abstract] OR hospitalist*[Title/Abstract] OR nursing[Title/Abstract] OR nurse[Title/Abstract] OR nurses[Title/Abstract] OR nutritionist*[Title/Abstract] OR occupational therapist*[Title/Abstract] OR physical therapist*[Title/Abstract] OR physician*[Title/Abstract] OR doctor[Title/Abstract] OR doctors[Title/Abstract] OR anesthesiologist*[Title/Abstract] OR anaesthesiologist*[Title/Abstract] OR cardiologist*[Title/Abstract] OR dermatologist*[Title/Abstract] OR endocrinologist*[Title/Abstract] OR gastroenterologist*[Title/Abstract] OR geriatrician*[Title/Abstract] OR nephrologist*[Title/Abstract] OR neurologist*[Title/Abstract] OR oncologist*[Title/Abstract] OR otolaryngologist*[Title/Abstract] OR pathologist*[Title/Abstract] OR neonatologist*[Title/Abstract] OR physiatrist*[Title/Abstract] OR pulmonologist*[Title/Abstract] OR radiologist*[Title/Abstract] OR rheumatologist*[Title/Abstract] OR surgeon*[Title/Abstract] OR neurosurgeon*[Title/Abstract] OR ophthalm*[Title/Abstract] OR urologist*[Title/Abstract])))) AND ((((("personal protective equipment"[MeSH Terms]) OR ("masks"[MeSH Terms])) OR ("respiratory protective devices"[MeSH Terms])) OR (gown*[Title/Abstract] OR coverall*[Title/Abstract] OR protective layer*[Title/Abstract] OR surgical toga[Title/Abstract] OR apron*[Title/Abstract] OR smock[Title/Abstract] OR smocks[Title/Abstract] OR hazmat suit*[Title/Abstract] OR glove*[Title/Abstract] OR mask[Title/Abstract] OR masks[Title/Abstract] OR respiratory protective device*[Title/Abstract] OR KN95[Title/Abstract] OR FFP2[Title/Abstract] OR FFP3[Title/Abstract] OR N95[Title/Abstract] OR P2[Title/Abstract] OR air-purifying respirator*[Title/Abstract] OR PAPR[Title/Abstract] OR "enhanced respiratory[Title/Abstract] AND contact precautions"[Title/Abstract] OR E-RCP[Title/Abstract] OR respiratory protection*[Title/Abstract] OR transparent panel*[Title/Abstract] OR filtering face piece*[Title/Abstract] OR filtering facepiece*[Title/Abstract] OR goggle*[Title/Abstract] OR visor[Title/Abstract] OR safety glass*[Title/Abstract] OR safety spectacles*[Title/Abstract] OR PPE[Title/Abstract] OR protect* equipment*[Title/Abstract] OR overshoe*[Title/Abstract] OR shoe cover*[Title/Abstract] OR rubber boot*[Title/Abstract] OR head cover*[Title/Abstract] OR face shield*[Title/Abstract] OR hood*[Title/Abstract]))) AND (("2020/01/01"[Date - Publication] : "3000"[Date - Publication]))) AND ("english"[Language])) AND ("review"[Publication Type])

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(“healthcare workers” or “health care workers” or “health care professionals” or “healthcare professionals” or “health practitioners” or “health personnel” or “emergency medical technicians” or pharmacists or nurses or physicians or doctors) 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 SARSCOV2 OR SARSCOV19 OR SARS-COV-19 OR SARSCOV-19 OR SARSCOV2019 OR SARS-COV-2019 OR SARSCOV-2019 OR "severe acute respiratory syndrome cov 2" OR "severe acute respiratory syndrome coronavirus*" OR "2019 ncov" OR 2019ncov OR Hcov*) AND (gown* or coverall* or protective layer* or surgical toga or apron* or smock or smocks or hazmat suit* or glove* or mask or masks or respiratory protective device* or KN95 or FFP2 or FFP3 or N95 or P2 or air-purifying respirator* or PAPR or "enhanced respiratory and contact precautions" or E-RCP or respiratory protection* or transparent panel* or filtering face piece* or filtering facepiece* or goggle* or visor or safety glass*

or safety spectacles* or PPE or protect* equipment* or overshoe* or shoe cover* or rubber boot* or head cover* or face shield* or hood*) from:2020

medRxiv & bioRxiv

Search terms: COVID ppe hospital health care workers review"

Limits: posted between "01 Jan, 2020 and 18 Nov, 2020"

Google / Google Scholar

health care workers PPE covid review

Question 4. Are there risks (to patient care, patient wellbeing, healthcare workers or adherence/behaviour) to use of continuous PPE/isolation?

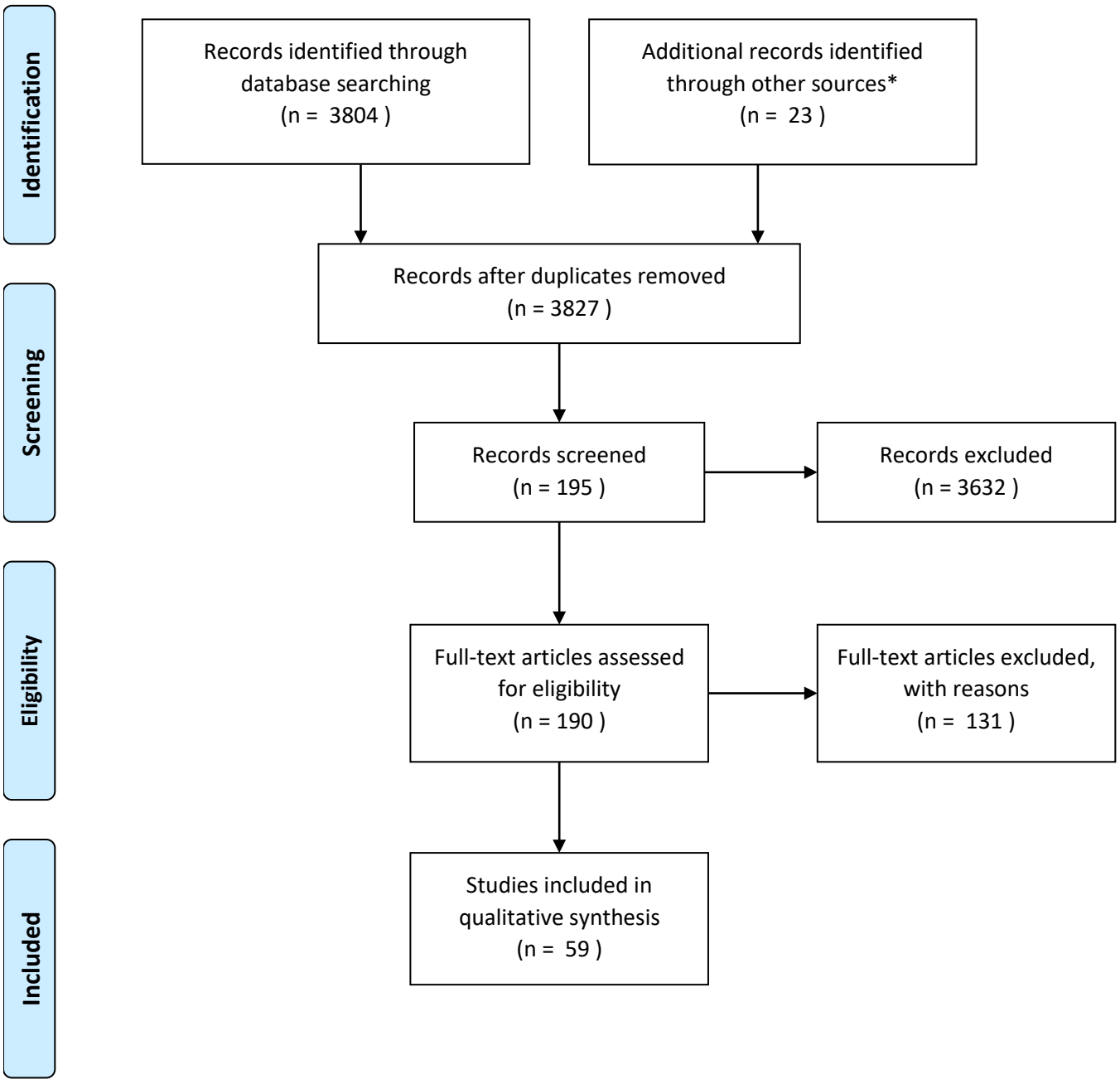
Literature Search

A search of the primary literature was conducted by Rachel Zhou from Knowledge Resources Services (KRS) within the Knowledge Management Department of Alberta Health Services. KRS searched in OVID MEDLINE, PubMed, TRIP PRO, Google and Google Scholar. Citation tracking was also used in Google Scholar. Briefly, the search strategy involved combinations of keywords for SARS-CoV-2; incidence/prevalence, disease transmission, outbreaks, and healthcare settings. Searches were limited to English, published between 2003 and 2020.

References identified by KRS in their search were initially screened and the inclusion/exclusion criteria listed in Table 11 below. There were 3804 citations identified by the initial search and screened. An additional 23 references were identified by an *ad hoc* search of Medline for references related isolation, irrespective of respiratory diease.. A total of 3827 references were reviewed and 3763 were excluded in accordance with the inclusion/exclusion criteria stated below. A total of 59 primary studies were included in the narrative synthesis. The PRISMA diagram (Moher et al., 2009) is included below as Figure 5.

Table 11. Inclusion and exclusion criteria for results of the literature search

Inclusion Criteria	Exclusion Criteria
- Patients diagnosed with and being treated for influenza, SARS-CoV-1, SARS-CoV-2, MERS, and RSV - Acute care, outpatient or ambulatory care (e.g., ED), long-term care - healthcare workers (HCW) wearing full PPE, continuous masking, and continuous full PPE - patient isolation (assumption that HCW wearing either full PPE, continuous masking, and continuous full PPE) - risks to healthcare workers (e.g., adherence, complacency, behaviour, wellbeing) - risks to patients (e.g., satisfaction, perception, morbidity/mortality, quality of care, wellbeing) - randomized controlled trials, non-randomized trials, cohort/observational studies, qualitative studies, mixed method studies, systematic reviews	- Grey literature, Commentaries, opinion pieces, editorials, animal studies, discovery research - Publications before 2003 - Not in settings of interest - No outcomes reported



* An ad hoc search was performed to identify additional literature related to isolation irrespective of respiratory disease. The 23 relevant findings were screened at the full text stage with the relevant studies from the initial database search.

Figure 5. PRISMA Diagram of studies relevant to Question 4.

Search Strategy for Question 4

Ovid MEDLINE(R) and Epub Ahead of Print, In-Process & Other Non-Indexed Citations, Daily and Versions(R) 1946 to November 17, 2020

#	Searches	Results
1	Personal Protective Equipment/ or exp masks/ or respiratory protective devices/	13420
2	(gown* or coverall* or protective layer* or surgical toga or apron* or smock or smocks or hazmat suit* or glove* or mask or masks or respiratory protective device* or KN95 or FFP2 or FFP3 or N95 or P2 or air-purifying respirator* or PAPR or "enhanced respiratory and contact precautions" or E-RCP or respiratory protection* or transparent panel* or filtering face piece* or filtering facepiece* or goggle* or visor or safety glass* or safety spectacles* or PPE or protect* equipment* or overshoe* or shoe cover* or rubber boot* or head cover* or face shield* or hood*).kf,tw.	101148
3	1 or 2	105313
4	exp Disease Transmission, Infectious/	71036
5	attitude/ or exp "attitude of health personnel"/ or exp "treatment adherence and compliance"/ or behavior/	469008
6	Perception/	35133
7	Social Isolation/	13859
8	exp "Quality of Health Care"/	7061722
9	exp "Quality of Life"/	199911
10	(transmission* or transmit* or perception or behavior?r* or complacen* or isolate* or quality of care or attitude or adheren* or complian* or quality of life).kf,tw.	2446258
11	or/4-10	9043569
12	3 and 11	35756
13	limit 12 to (english language and yr="2003 -Current")	24331
14	exp Coronavirus/ or Coronavirus Infections/ or (coronaviru* or corona viru* or ncov* or n-cov* or novel cov* or COVID-19 or COVID19 or COVID-2019 or COVID2019 or SARS-CoV-2 or SARSCoV-2 or SARSCoV2 or SARSCoV19 or SARS-Cov-19 or SARSCov-19 or SARSCoV2019 or SARS-Cov-2019 or SARSCov-2019 or severe acute respiratory syndrome coronaviru* or severe acute respiratory syndrome cov 2 or 2019 ncov or 2019ncov).kf,tw.	91376
15	Middle East Respiratory Syndrome Coronavirus/	1395
16	Severe Acute Respiratory Syndrome/	5307
17	Pandemics/	40824
18	Influenza, Human/	50100
19	Respiratory Syncytial Virus Infections/	7078
20	(middle east respiratory syndrome or mers or mers-cov or severe acute respiratory syndrome or sars or sars-cov or respiratory syncytial virus infection* or rsv or influenza or pandemic*).kf,tw.	178754
21	or/14-20	225642
22	13 and 21	2866

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((((((("personal protective equipment"[MeSH Terms]) OR ("masks"[MeSH Terms])) OR ("respiratory protective devices"[MeSH Terms])) OR (gown*[Title/Abstract] OR coverall*[Title/Abstract] OR protective layer*[Title/Abstract] OR surgical toga[Title/Abstract] OR apron*[Title/Abstract] OR smock[Title/Abstract] OR smocks[Title/Abstract] OR hazmat suit*[Title/Abstract] OR glove*[Title/Abstract] OR mask[Title/Abstract] OR masks[Title/Abstract] OR respiratory protective device*[Title/Abstract] OR KN95[Title/Abstract] OR FFP2[Title/Abstract] OR FFP3[Title/Abstract] OR N95[Title/Abstract] OR P2[Title/Abstract] OR air-purifying respirator*[Title/Abstract] OR PAPR[Title/Abstract] OR "enhanced respiratory[Title/Abstract] AND contact precautions"[Title/Abstract] OR E-RCP[Title/Abstract] OR respiratory protection*[Title/Abstract] OR transparent panel*[Title/Abstract] OR filtering face piece*[Title/Abstract] OR filtering facepiece*[Title/Abstract] OR goggle*[Title/Abstract] OR visor[Title/Abstract] OR safety glass*[Title/Abstract] OR safety spectacles*[Title/Abstract] OR PPE[Title/Abstract] OR protect* equipment*[Title/Abstract] OR overshoe*[Title/Abstract] OR shoe cover*[Title/Abstract] OR rubber boot*[Title/Abstract] OR head cover*[Title/Abstract] OR face shield*[Title/Abstract] OR hood*[Title/Abstract])) AND (((((((("disease transmission, infectious"[MeSH Terms]) OR ("attitude"[MeSH Major Topic])) OR ("attitude of health personnel"[MeSH Terms])) OR ("treatment adherence and compliance"[MeSH Terms])) OR ("perception"[MeSH Major Topic])) OR ("social isolation"[MeSH Major Topic])) OR ("quality of health care"[MeSH Major Topic])) OR ("quality of life"[MeSH Terms])) OR (transmission*[Title/Abstract] OR transmit*[Title/Abstract] OR perception[Title/Abstract] OR behavior?r*[Title/Abstract] OR complacen*[Title/Abstract] OR isolate*[Title/Abstract] OR quality of care[Title/Abstract] OR attitude[Title/Abstract] OR adheren*[Title/Abstract] OR complian*[Title/Abstract] OR quality of life[Title/Abstract]))) AND ((((((("middle east respiratory syndrome coronavirus"[MeSH Terms]) OR (Severe Acute Respiratory Syndrome[MeSH Terms])) OR ("pandemics"[MeSH Terms])) OR ("influenza, human"[MeSH Terms])) OR ("respiratory syncytial virus infections"[MeSH Terms])) OR (middle east respiratory syndrome[Title/Abstract] OR mers[Title/Abstract] OR mers-cov[Title/Abstract] OR severe acute respiratory syndrome[Title/Abstract] OR sars[Title/Abstract] OR sars-cov[Title/Abstract] OR respiratory syncytial virus infection*[Title/Abstract] OR rsv[Title/Abstract] OR influenza[Title/Abstract] OR pandemic*[Title/Abstract]))) AND (("english"[Language]) AND (("2020/01/01"[Date - Publication] : "3000"[Date - Publication])))

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(coronaviru* OR "corona virus" OR COVID-19 OR COVID-2019 OR SARS-COV-2 OR SARSCOV-2 OR SARS-COV-19 OR SARSCOV-19 OR SARS-COV-2019 OR SARSCOV-2019 OR "severe acute respiratory syndrome cov 2" OR "severe acute respiratory syndrome coronavirus*" OR "2019 ncov" OR 2019ncov OR Hcov* or middle east respiratory syndrome or mers or mers-cov or severe acute respiratory syndrome or sars or sars-cov or respiratory syncytial virus infection* or rsv or influenza or pandemic*) AND (gown* or coverall* or protective layer* or surgical toga or apron* or smock or smocks or hazmat suit* or glove* or mask or masks or respiratory protective device* or KN95 or FFP2 or FFP3 or N95 or P2 or air-purifying respirator* or PAPR or "enhanced respiratory and contact precautions" or E-RCP or respiratory protection* or transparent panel* or filtering face piece* or filtering facepiece* or goggle* or visor or safety glass* or safety spectacles* or PPE or protect* equipment* or overshoe* or shoe cover* or rubber boot* or head cover* or face shield* or hood*) AND (transmission* or transmit* or perception or behavior?r* or complacen* or isolate* or quality of care or attitude or adheren* or complian* or quality of life)

Google / Google Scholar

ppe impact on patient care

Question 5. Which care areas (e.g. ICU, emergency, perioperative care) pose the highest risk of COVID-19 for healthcare workers?

Literature Search

A literature search was conducted by Rachel Zhou from Knowledge Resources Services (KRS) within the Knowledge Management Department of Alberta Health Services. KRS searched databases for articles published from January 1, 2020 to present, and included: OVID MEDLINE, PubMed, and Google Scholar. Briefly, the search strategy involved combinations of keywords and subject headings including:

- SARS-CoV-2; COVID-19
- Healthcare or hospital setting
- Occupational exposure or risk
- Healthcare worker

Articles identified by KRS in their search were initially screened by title against the inclusion/exclusion criteria listed in Table 12 below. Eight-hundred and seventy-nine articles were identified by KRS with references and abstracts provided for further review. An additional 49 articles were identified from hand-searching the reference lists of 3 relevant systematic reviews and 1 living rapid review. A total of 924 articles underwent abstract review and of these, 76 were reviewed in full-text. Ultimately, 54 were excluded from the review in accordance with the inclusion/exclusion criteria stated below. A total of 22 articles were included in the narrative synthesis. The PRISMA flow diagram for this rapid review is provided in Figure 6.

Table 12. Inclusion and exclusion criteria for results of the literature search

Inclusion Criteria	Exclusion Criteria
- Original research (primary studies) - Date of research: January 1 2020-present to capture articles relevant to the COVID-19 pandemic - Participants: healthcare workers from any acute care facility or hospital that treated COVID-19 patients - Exposure/comparator: areas of care (i.e., primary clinical area of work) as risk factors for COVID-19 infection - Outcome: relative risk or association between HCWs' area of care (i.e., primary clinical location of work) and COVID-19 infection (reported as a measure of association e.g., odds ratios, risk ratios, prevalence ratios, incidence risk ratios, etc) - Setting: any acute care facility or hospital wherein areas of care are clearly described and evaluated - Primary study designs of interest: observational studies (prospective cohort, retrospective cohort, case-control, cross-sectional, case series) - Other study designs of interest: randomized-controlled trials, non-randomized trials or quasi-experimental studies	- Grey literature or article not from a credible source - Articles written as commentaries, opinion pieces, editorials, or systematic or narrative literature reviews (systematic reviews to be hand-searched) - Animal studies - Studies that do not have a clear research question or issue - Studies that do not have a relevant comparator(s) - Studies that only report prevalence (i.e., no relative risk or association data) - Studies that do not present quantitative data or data/evidence that is not sufficient to address the research questions - Studies that do not include areas of care as an examined risk factor for COVID-19

- Published peer-review articles, peer-reviewed pre-proof articles, and non-peer-reviewed pre-print articles
- Any geographic location
- English language only

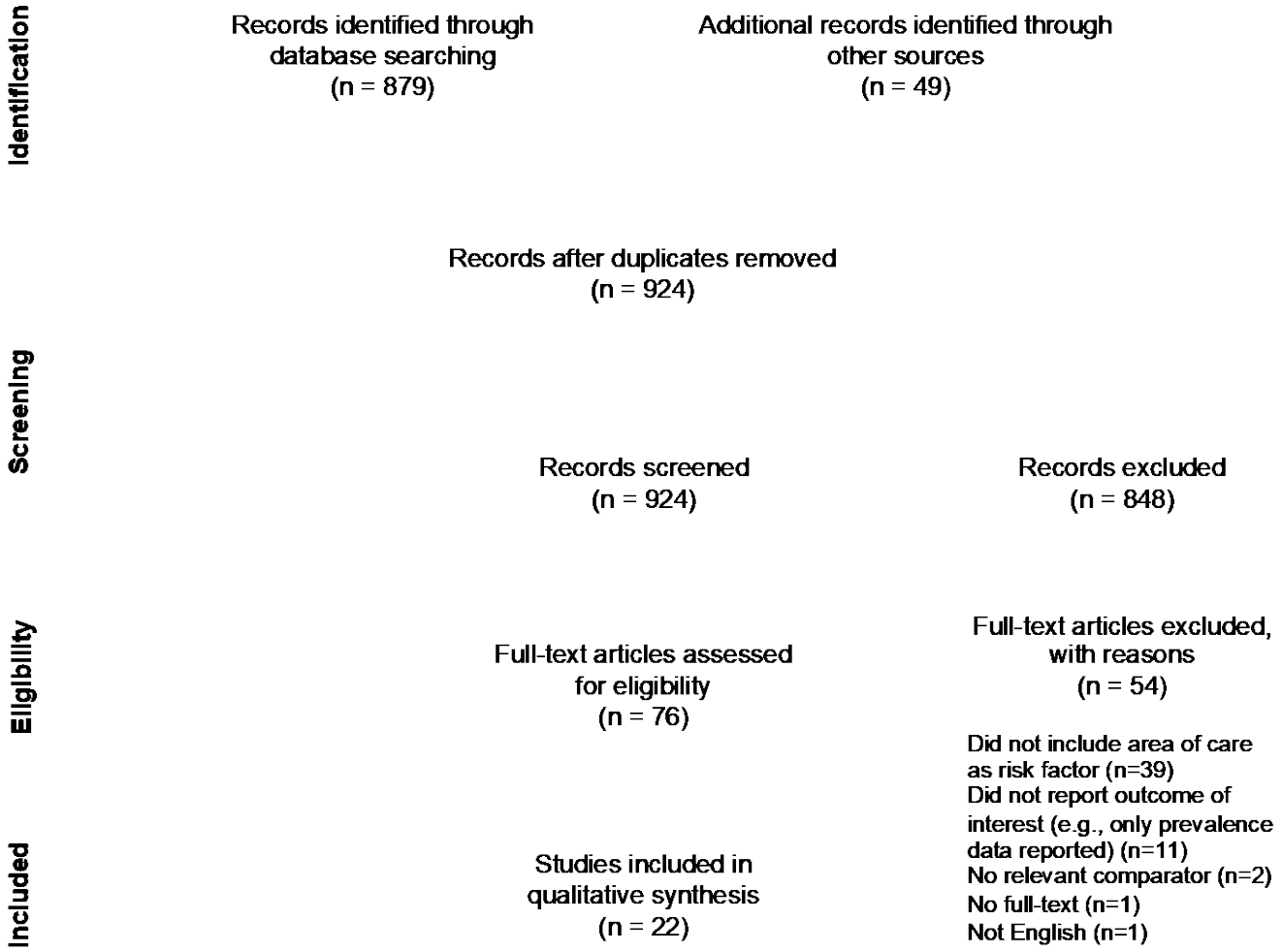

Figure 6. PRISMA flow diagram of studies relevant to question 5.

Search Strategy for Question 5

Ovid MEDLINE(R) and Epub Ahead of Print, In-Process & Other Non-Indexed Citations, Daily and Versions(R) 1946 to November 17, 2020

Search Strategy:

#	Searches	Results
1	exp Coronavirus/ or Coronavirus Infections/ or (coronaviru* or corona viru* or ncov* or n-cov* or novel cov* or COVID-19 or COVID19 or COVID-2019 or COVID2019 or SARS-CoV-2 or SARSCoV-2 or SARSCoV2 or SARSCoV19 or SARS-Cov-19 or SARSCov-19 or SARSCoV2019 or SARS-Cov-2019 or SARSCov-2019 or severe acute respiratory syndrome coronaviru* or severe acute respiratory syndrome cov 2 or 2019 ncov or 2019ncov).kf,tw.	91376
2	exp academic medical centers/ or exp ambulatory care facilities/ or exp hospitals/ or exp residential facilities/	413867
3	exp Hospital Units/	113865
4	Emergency Service, Hospital/	70690
5	(hospital or hospitals or long term care or nursing home* or acute care or hospital unit* or clinical observation unit* or delivery room* or h?emodialysis unit* or intensive care unit* or burn units* or coronary care unit* or intensive care unit* or recovery room* or respiratory care unit* or nursing station* or operating room* or self-care unit* or ER or ED or emergency department*).kf,tw.	1490219
6	or/2-5	1740731
7	exp Occupational Exposure/	64134
8	exp risk/	1230422
9	(expos* or risk*).kf,tw.	3304190
10	or/7-9	3760891
11	exp *Health Personnel/	382509
12	(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).kf,ti.	33949
13	(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	34728

	professional* or health care professional* or health-care professional* or health worker* or health personnel).ab. /freq=2	
14	or/11-13	420532
15	1 and 6 and 10 and 14	561
16	limit 15 to (english language and yr="2020 -Current" and covid-19)	475

PubMed

((((((("coronavirus"[MeSH Terms]) OR ("coronavirus infections"[MeSH Terms])) OR (coronaviru*[Title/Abstract] OR corona viru*[Title/Abstract] OR ncov*[Title/Abstract] OR n-cov*[Title/Abstract] OR novel cov*[Title/Abstract] OR COVID-19[Title/Abstract] OR COVID19[Title/Abstract] OR COVID-2019[Title/Abstract] OR COVID2019[Title/Abstract] OR SARS-CoV-2[Title/Abstract] OR SARSCoV-2[Title/Abstract] OR SARSCoV2[Title/Abstract] OR SARSCoV19[Title/Abstract] OR SARS-Cov-19[Title/Abstract] OR SARSCov-19[Title/Abstract] OR SARSCoV2019[Title/Abstract] OR SARS-Cov-2019[Title/Abstract] OR SARSCov-2019[Title/Abstract] OR severe acute respiratory syndrome coronaviru*[Title/Abstract] OR severe acute respiratory syndrome cov 2[Title/Abstract] OR 2019 ncov[Title/Abstract] OR 2019ncov[Title/Abstract])) AND (((((("academic medical centers"[MeSH Terms]) OR ("ambulatory care facilities"[MeSH Terms])) OR ("hospital units"[MeSH Terms])) OR ("hospitals"[MeSH Terms])) OR ("residential facilities"[MeSH Terms])) OR ("emergency service, hospital"[MeSH Terms])) OR (hospital[Title/Abstract] OR hospitals[Title/Abstract] OR long term care[Title/Abstract] OR nursing home*[Title/Abstract] OR acute care[Title/Abstract] OR hospital unit*[Title/Abstract] OR clinical observation unit*[Title/Abstract] OR delivery room*[Title/Abstract] OR h?emodialysis unit*[Title/Abstract] OR intensive care unit*[Title/Abstract] OR burn units*[Title/Abstract] OR coronary care unit*[Title/Abstract] OR intensive care unit*[Title/Abstract] OR recovery room*[Title/Abstract] OR respiratory care unit*[Title/Abstract] OR nursing station*[Title/Abstract] OR operating room*[Title/Abstract] OR self-care unit*[Title/Abstract] OR ER[Title/Abstract] OR ED[Title/Abstract] OR emergency department*[Title/Abstract]))) AND ((("occupational exposure"[MeSH Terms]) OR ("risk"[MeSH Terms])) OR (expos*[Title/Abstract] OR risk*[Title/Abstract]))) AND (("health personnel"[MeSH Major Topic]) OR (health practitioner*[Title/Abstract] OR health professional*[Title/Abstract] OR healthcare worker*[Title/Abstract] OR health care worker*[Title/Abstract] OR health-care worker*[Title/Abstract] OR healthcare personnel[Title/Abstract] OR health care personnel[Title/Abstract] OR health-care personnel[Title/Abstract] OR healthcare practitioner*[Title/Abstract] OR health care practitioner*[Title/Abstract] OR health-care practitioner*[Title/Abstract] OR healthcare professional*[Title/Abstract] OR health care professional*[Title/Abstract] OR health-care professional*[Title/Abstract] OR health worker*[Title/Abstract] OR health personnel[Title/Abstract]))) AND (("english"[Language]) AND (("2020/01/01"[Date - Publication] : "3000"[Date - Publication])))

Google Scholar

Citation tracking was conducted on the following two articles identified by reviewers, as well as the additional articles identified during the process of citation tracking.

Ran, L., Chen, X., Wang, Y., Wu, W., Zhang, L., Li, R., … Xiaodong, T. (2020). Risk Factors of Healthcare Workers with Corona Virus Disease 2019: A Retrospective Cohort Study in a Designated Hospital of Wuhan in China. Clinical Infectious Diseases : An Official Publication of the Infectious Diseases Society of America. https://doi.org/http://dx.doi.org/10.1093/cid/ciaa287

Hunter, E., Price, D. A., Murphy, E., van der Loeff, I. S., Baker, K. F., Lendrem, D., … Duncan, C. J. A. (2020). First experience of COVID-19 screening of health-care workers in England. https://doi.org/10.1016/S0140-6736(20)30970-3

Reference List

Abad, C., Fearday, A., & Safdar, N. (2010). Adverse effects of isolation in hospitalised patients: a systematic review. The Journal of hospital infection, 76(2), 97–102. https://doi.org/10.1016/j.jhin.2010.04.027

Algado-Sellés N, Gras-Valentí P, Chico-Sánchez P, Mora-Muriel JG, Soler-Molina VM, Hernández-Maldonado M, et al. (2020). Frequency, Associated Risk Factors, and Characteristics of COVID-19 Among Healthcare Personnel in a Spanish Health Department. *American Journal of Preventive Medicine*, 59(6):e221–9. https://doi.org/10.1016/j.amepre.2020.07.014

Arasli, H., Furunes, T., Jafari, K., Saydam, M. B., & Degirmencioglu, Z. (2020). Hearing the Voices of Wingless Angels: A Critical Content Analysis of Nurses' COVID-19 Experiences. International journal of environmental research and public health, 17(22), E8484. https://doi.org/10.3390/ijerph17228484

Asadi L, MackKay E, Saxinger L, Lee N, Manns B, Conly J, Doroshenko A, Duggan S, McRae A, Slobodan J, Talbot J, Walker B, Zelyas N. What is the effectiveness of wearing medical masks, including home-made masks, to reduce the spread of COVID-19 in the community? [Updated June 19, 2020]. COVID-19 Scientific Advisory Group, Alberta Health Services 2020; https://www.albertahealthservices.ca/assets/info/ppih/if-ppih-covid-19-sag-mask-use-in-community-rapid-review.pdf

Atay, S., & Cura, Ş. Ü. (2020). Problems Encountered by Nurses Due to the Use of Personal Protective Equipment During the Coronavirus Pandemic: Results of a Survey. Wound management & prevention, 66(10), 12–16.

Australian Government (Department of Health). (2020). Guidance on the minimum recommendations for the use of personal protective equipment (PPE) in hospitals during the COVID-19 outbreak. https://www.health.gov.au/resources/publications/guidance-on-the-use-of-personal-protective-equipment-ppe-in-hospitals-during-the-covid-19-outbreak

Australian Government (Department of Health). (2020). Infection Control Expert Group COVID-19 Infection Prevention and Control for Residential Care Facilities. https://www.health.gov.au/resources/publications/coronavirus-covid-19-guidelines-for-infection-prevention-and-control-in-residential-care-facilities

Australian Government (Department of Health). (2020). Recommended minimum requirements for the use of masks or respirators by health and residential care workers in areas with significant community transmission of COVID-19. https://www.health.gov.au/resources/publications/iceg-guidance-masks-respirators-health-residential-care-workers

Bandaru, S. V., Augustine, A. M., Lepcha, A., Sebastian, S., Gowri, M., Philip, A., & Mammen, M. D. (2020). The effects of N95 mask and face shield on speech perception among healthcare workers in the coronavirus disease 2019 pandemic scenario. The Journal of laryngology and otology, 1–4. Advance online publication. https://doi.org/10.1017/S0022215120002108

Barasheed, O. , Almasri, N. , Badahdah, A.M. , Heron, L. , Taylor, J. , McPhee, K. , et al. ,2014. Pilot randomised controlled trial to test effectiveness of facemasks in preventing influenza-like illness transmission among Australian Hajj Pilgrims in 2011. Infect. Disord. Drug Targets. 14 (2), 110–116 .

Bartoszko, J.J., Farooqi, M.A.M., Alhazzani, W., Loeb, M. Medical masks vs N95 respirators for preventing COVID-19 in healthcare workers: a systematic review and meta-analysis of randomized trials. Influenza Other Respir Viruses 2020; 14:364-373. DOI: 10.1111/irv.12745

Baxendale HE, Wells D, Gronlund J, Nadesalingam A, Paloniemi M, Carnell G, et al. (2020). Critical care workers have lower seroprevalence of SARS-CoV-2 IgG compared with non-patient facing staff in first wave of COVID19. https://doi.org/10.1101/2020.11.12.20145318

BC Centre for Disease Control. (2020). Infection Prevention and Control Requirements for COVID-19 in Long Term Care and Seniors' Assisted Living. http://www.bccdc.ca/Health-Info-Site/Documents/COVID19_LongTermCareAssistedLiving.pdf

BC Centre for Disease Control. (2020). Personal Protective Equipment. http://www.bccdc.ca/health-professionals/clinical-resources/covid-19-care/infection-control/personal-protective-equipment

Berry D, Wakefield E, Street M & Considine J. (2020). Clinical deterioration and hospital-acquired complications in adult patients with isolation precautions for infection control: A systematic review. Journal of Advanced Nursing, 76, 2235-2252. https://doi.org/10.1111/jan.14435

Bhaskar, M.E., Arun, S. SARS-CoV-2 infection among community health workers in India before and after use of face shields. JAMA 6 Oct 2020;
324(13). https://jamanetwork.com/journals/jama/fullarticle/10.1001/jama.2020.15586?utm_campaign=articlePDF%26utm_medium=articlePDFlink%26utm_source=articlePDF%26utm_content=jama.2020.15586

Bistoquet M, Galtier F, Marin G, Villard O, Ferreira R, Hermabessiere S, et al. (2020). Increased risks of SARS CoV-2 Nosocomial Acquisition in high-risk COVID-19 units justify personal Protective Equipment: a cross sectional study. *Journal of Hospital Infection*. https://doi.org/10.1016/j.jhin.2020.10.022

Bothra, A., Das, S., Singh, M., Pawar, M., & Maheswari, A. (2020). Retroauricular dermatitis with vehement use of ear loop face masks during COVID-19 pandemic. Journal of the European Academy of Dermatology and Venereology : JEADV, 34(10), e549–e552. https://doi.org/10.1111/jdv.16692

Brown, K.A., Jones, A., Daneman, N., Chan, A.K., Schwartz, K.L, Garber, G.E., … Stall, N.M. (2020). Association Between Nursing Home Crowding and COVID-19 Infection and Mortality in Ontario, Canada. JAMA Intern Med 2020.6446. doi:10.1001/jamainternmed.2020.6466

Bui, D., See, I., Hesse, E., Varela, K., Harvey, R., August, E., … Atkins, A. (2020). Association Between CMS Quality Ratings and COVID-19 Outbreaks in Nursing Homes — West Virginia, March 17–June 11, 2020. MMWR. Morbidity and Mortality Weekly Report , 69(37), 1300–1304.

Canini L., Andreoletti L., Ferrari P., D'Angelo R., Blanchon T., Lemaitre M., et al. Surgical mask to prevent influenza transmission in households: a cluster randomized trial. PLoS ONE 2010. 5(11):e13998.

Carbon C. C. (2020). Wearing Face Masks Strongly Confuses Counterparts in Reading Emotions. Frontiers in psychology, 11, 566886. https://doi.org/10.3389/fpsyg.2020.566886

Catalano G, Houston SH, Catalano MC, Butera AS, Jennings SM, Hakala SM, et al. (2003). Anxiety and depression in hospitalized patients in resistant organism isolation. Southern Medical Journal, 96, 141-5. https://doi.org/10.1097/01.SMJ.0000050683.36014.2E

Celebi G, Piskin N, Celik Beklevic A, Altunay YY, Salci Keles A, Tuz MA, et al. (2020). Specific risk factors for SARS-CoV-2 transmission among health care workers in a university hospital. *American Journal of Infection Control,* 48(10):1225–30. https://doi.org/10.1016/j.ajic.2020.07.039

Centers for Disease Control and Prevention (CDC). (2020). Interim Infection Prevention and Control Recommendations for Healthcare Personnel During the Coronavirus Disease 2019 (COVID-19) Pandemic. https://www.cdc.gov/coronavirus/2019-ncov/hcp/infection-control.html

Chatterjee P, Anand T, Singh KJ, et al. (2020). Healthcare workers & SARS-CoV-2 infection in India: A case control investigation in the time of COVID-19. *Indian Journal of Medical Research*,151:459-467. https://doi.org/10.4103/ijmr.IJMR_2234_20

Chatterjee, P., Kelly, S., Qi, M., & Werner, R.M. (2020). Characteristics and Quality of US Nursing Homes Reporting Cases of Coronavirus Disease 2019 (COVID-19). The Journal of the American Medical Association Network Open, 3(7), e2016930.

Chou, R., Dana, T., Jungbauer, R., Weeks, C., & McDonagh, M. S. (2020). Masks for Prevention of Respiratory Virus Infections, Including SARS-CoV-2, in Health Care and Community Settings : A Living Rapid Review. Annals of internal medicine, 173(7), 542–555. https://doi.org/10.7326/M20-3213

Chu, D.K., Akl, E. A, Duda, S et al. Physical distancing, face masks, and eye protection to prevent person-to-person transmission of SARS-CoV-2 and COVID-19: a systematic review and meta-analysis. Lancet Infect Dis 2020; 395: 1973-87. https://doi.org/10.1016/S0140-6736(20)31142-9

Chughtai AA, Chen X, Macintyre CR. Risk of self-contamination during doffing of personal protective equipment. AJIC 2018; 46(12): 1329-1334 https://doi.org/10.1016/j.ajic.2018.06.003

Ciris Yildiz C, Ulasli Kaban H & Tanriverdi FS. (2020). COVID-19 pandemic and personal protective equipment: Evaluation of equipment comfort and user attitude. Archives of Environmental & Occupational Health, 1-8. https://doi.org/10.1080/19338244.2020.1828247, 10.1080/19338244.2020.1828247

Cohen E, Austin J, Weinstein M, Matlow A & Redelmeier DA. (2008). Care of children isolated for infection control: a prospective observational cohort study. Pediatrics, 122, e411-5. https://doi.org/10.1542/peds.2008-0181, 10.1542/peds.2008-0181

Colaneri M, Novelli V, Cutti S, Muzzi A, Resani G, Monti MC, et al. The experience of the health care workers of a severely hit SARS-CoV-2 referral Hospital in Italy: incidence, clinical course and modifiable risk factors for COVID-19 infection. *Journal of Public Health (Oxf).* https://doi.org/10.1093/pubmed/fdaa195

Cooper DJ, Lear S, Watson L, Shaw A, Ferris M, Doffinger R, et al. (2020). A prospective study of risk factors associated with seroprevalence of SARS-CoV-2 antibodies in healthcare workers at a large UK teaching hospital. https://doi.org/10.1101/2020.11.03.2022069

Corley, A., Hammond, N. E., & Fraser, J. F. (2010). The experiences of health care workers employed in an Australian intensive care unit during the H1N1 Influenza pandemic of 2009: a phenomenological study. International journal of nursing studies, 47(5), 577–585. https://doi.org/10.1016/j.ijnurstu.2009.11.015

Daugherty, E. L., Perl, T. M., Needham, D. M., Rubinson, L., Bilderback, A., & Rand, C. S. (2009). The use of personal protective equipment for control of influenza among critical care clinicians: a survey study. Critical Care Medicine, 37(4), 1210-1216.

Day HR, Perencevich EN, Harris AD, Gruber-Baldini AL, Himelhoch SS, Brown CH, et al. (2012). Association between contact precautions and delirium at a tertiary care center. Infection Control & Hospital Epidemiology, 33, 34-9. https://doi.org/10.1086/663340, 10.1086/663340

Dean, A., Venkataramani, A., & Kimmel, S. (2020). Mortality Rates From COVID-19 Are Lower In Unionized Nursing Homes. Health Affairs. Epub ahead of print.

Department of Health and Social Care (DHSC), Public Health Wales (PHW), Public Health Agency (PHA) Northern Ireland, Health Protection Scotland (HPS)/National Services Scotland, Public Health England (PHE) and NHS England. (2020). COVID-19: Guidance for the remobilisation of services within health and care settings: Infection prevention and control recommendations. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/910885/COVID-19_Infection_prevention_and_control_guidance_FINAL_PDF_20082020.pdf

Emmerson, C., Adamson, J.P., Turner, D., Gravenor, M.B, Salmon, J., Cottrell, S., … Williams, C.J. (2020). Risk factors for outbreaks of COVID-19 in care homes following hospital discharge: a national cohort analysis. Preprint. https://doi.org/10.1101/2020.08.24.20168955

European Centre for Disease Control (ECDC). (2020). Guidance for wearing and removing personal protective equipment in healthcare settings for the care of patients with suspected or confirmed COVID-19. https://www.ecdc.europa.eu/en/publications-data/guidance-wearing-and-removing-personal-protective-equipment-healthcare-settings

Eyre DW, Lumley SF, O'Donnell D, Campbell M, Sims E, Lawson E, et al. (2020). Differential occupational risks to healthcare workers from SARS-CoV-2 observed during a prospective observational study. *Elife,* 9:e60675. https://doi.org/10.7554/eLife.60675

Farronato, M., Boccalari, E., Del Rosso, E., Lanteri, V., Mulder, R., & Maspero, C. (2020). A Scoping Review of Respirator Literature and a Survey among Dental Professionals. International journal of environmental research and public health, 17(16), 5968. https://doi.org/10.3390/ijerph17165968

Firew T, Sano ED, Lee JW, Flores S, Lang K, Salman K, et al. (2020). Protecting the front line: a cross-sectional survey analysis of the occupational factors contributing to healthcare workers' infection and psychological distress during the COVID-19 pandemic in the USA. *BMJ Open*, 10(10):e042752. http://dx.doi.org/10.1136/bmjopen-2020-042752

Galan I, Velasco M, Casas ML, Goyanes MJ, Rodriguez-Caravaca G, Losa JE, et al. (2020). SARS-CoV-2 Seroprevalence among all workers in a teaching hospital in Spain: Unmasking the risk. https://doi.org/10.1101/2020.05.29.20116731

Galehdar, N., Kamran, A., Toulabi, T., & Heydari, H. (2020). Exploring nurses' experiences of psychological distress during care of patients with COVID-19: a qualitative study. BMC psychiatry, 20(1), 489. https://doi.org/10.1186/s12888-020-02898-1

Garcia-Basteiro AL, Moncunill G, Tortajada M, Vidal M, Guinovart C, Jiménez A, et al. (2020). Seroprevalence of antibodies against SARS-CoV-2 among health care workers in a large Spanish reference hospital. *Nature Communications,* 11(1):3500. https://doi.org/10.1038/s41467-020-17318-x

Gasink, L. B., Singer, K., Fishman, N. O., Holmes, W. C., Weiner, M. G., Bilker, W. B., & Lautenbach, E. (2008). Contact isolation for infection control in hospitalized patients: is patient satisfaction affected?. Infection control and hospital epidemiology, 29(3), 275–278. https://doi.org/10.1086/527508

Giannaccare, G., Vaccaro, S., Mancini, A., & Scorcia, V. (2020). Dry eye in the COVID-19 era: how the measures for controlling pandemic might harm ocular surface. Graefe's archive for clinical and experimental ophthalmology = Albrecht von Graefes Archiv fur klinische und experimentelle Ophthalmologie, 258(11), 2567–2568. https://doi.org/10.1007/s00417-020-04808-3

Gorges, R.J., & Konetzka, R.T. (2020). Staffing Levels and COVID-19 Cases and Outbreaks in U.S. Nursing Homes. Journal of the American Geriatrics Society, 2020: Epub ahead of print. https://dx.doi.org/10.1111%2Fjgs.16787

Gupta M, Singh A & Gupta M. (2020). An Otorhinolaryngologists Perspective on Using Face Masks by Health Care Professionals Based on an Online Survey. Indian Journal of Otolaryngology & Head & Neck Surgery, 1-6. https://doi.org/10.1007/s12070-020-02248-3, 10.1007/s12070-020-02248-3

Hampton, T., Crunkhorn, R., Lowe, N., Bhat, J., Hogg, E., Afifi, W., De, S., Street, I., Sharma, R., Krishnan, M., Clarke, R., Dasgupta, S., Ratnayake, S., & Sharma, S. (2020). The negative impact of wearing personal protective equipment on communication during coronavirus disease 2019. The Journal of laryngology and otology, 134(7), 577–581. https://doi.org/10.1017/S0022215120001437

Harrington, C., Ross, L., Chapman, S., Halifax, E., Spurlock, B., & Bakerjian, D. (2020). Nurse Staffing and Coronavirus Infections in California Nursing Homes. Policy, Politics & Nursing Practice, 21(3), 174–186. https://doi.org/10.1177%2F1527154420938707

Hines, S. E., Oliver, M. S., Gucer, P., & McDiarmid, M. A. (2020). Self-reported impact of respirator use on health care worker ability to perform patient care. American journal of infection control, 48(12), 1556–1558. https://doi.org/10.1016/j.ajic.2020.06.005

Houghton, C., Meskell, P., Delaney, H., Smalle, M., Glenton, C., Booth, A., Chan, X., Devane, D., & Biesty, L. M. (2020). Barriers and facilitators to healthcare workers' adherence with infection prevention and control (IPC) guidelines for respiratory infectious diseases: a rapid qualitative evidence synthesis. The Cochrane database of systematic reviews, 4(4), CD013582. https://doi.org/10.1002/14651858.CD013582

Hu, K., Fan, J., Li, X., Gou, X., Li, X., & Zhou, X. (2020). The adverse skin reactions of health care workers using personal protective equipment for COVID-19. Medicine, 99(24), e20603. https://doi.org/10.1097/MD.0000000000020603

Iannone, P., Castellini, G., Coclite, D., et al. The need of health policy perspective to protect healthcare workers during COVID-19 pandemic. A GRADE rapid review on the N95 respirators effectiveness. PLoS ONE 15(6):e0234025. https://doi.org/10.1371/journal.pone.0234025

Iversen K, Bundgaard H, Hasselbalch RB, Kristensen JH, Nielsen PB, Pries-Heje M, et al. (2020). Risk of COVID-19 in health-care workers in Denmark: an observational cohort study. *Lancet Infectious Disease,* 20(12):1401-1408. https://doi.org/10.1016/S1473-3099(20)30589-2

Jefferson, T., Del Mar C.B., Dooley, L. et al. Physical interventions to interrupt or reduce the spread of respiratory viruses (Review). Cochrane Database of Systematic Revies 2020, Issue 11. Art. No.:CD006207. https://doi.org/10.1002%2F14651858.CD006207.pub5

Jesus JB, Dias AAL & Figueiredo RM. (2019). Specific precautions: experiences of hospitalized patients. Revista Brasileira de Enfermagem, 72, 874-879. https://doi.org/10.1590/0034-7167-2017-0888, 10.1590/0034-7167-2017-0888

Jiang, Q., Song, S., Zhou, J., Liu, Y., Chen, A., Bai, Y., Wang, J., Jiang, Z., Zhang, Y., Liu, H., Hua, J., Guo, J., Han, Q., Tang, Y., & Xue, J. (2020). The Prevalence, Characteristics, and Prevention Status of Skin Injury Caused by Personal Protective Equipment Among Medical Staff in Fighting COVID-19: A Multicenter, Cross-Sectional Study. Advances in wound care, 9(7), 357–364. https://doi.org/10.1089/wound.2020.1212

Johnson D.F., Druce J.D, Birch, C., Grayson, L. A quantitative assessment of the efficacy of surgical and N95 masks to filter influenza virus in patients with acute influenza infection. Clin Infect Dis 2009: 49:275-7. https://doi.org/10.1086/600041

Jones N.K., Rivett, L., Sparkes D., et al. Effective control of SARS-CoV-2 transmission between healthcare workers during a period of diminished community prevalence of COVID-19. eLife 2020; 9:e59391. https://doi.org/10.7554/eLife.59391

Kang, H. S., Son, Y. D., Chae, S. M., & Corte, C. (2018). Working experiences of nurses during the Middle East respiratory syndrome outbreak. International journal of nursing practice, 24(5), e12664. https://doi.org/10.1111/ijn.12664

Karki S, Leder K & Cheng AC. (2013). Patients under contact precautions have an increased risk of injuries and medication errors: a retrospective cohort study. Infection Control & Hospital Epidemiology, 34, 1118-20. https://doi.org/10.1086/673153, 10.1086/673153

Khan FA, Khakoo RA & Hobbs GR. (2006). Impact of contact isolation on health care workers at a tertiary care center. American Journal of Infection Control, 34, 408-13. https://doi.org/10.1016/j.ajic.2005.08.013

Khoo, K. L., Leng, P. H., Ibrahim, I. B., & Lim, T. K. (2005). The changing face of healthcare worker perceptions on powered air-purifying respirators during the SARS outbreak. Respirology (Carlton, Vic.), 10(1), 107–110. https://doi.org/10.1111/j.1440-1843.2005.00634.x

Klimek, L., Huppertz, T., Alali, A., Spielhaupter, M., Hörmann, K., Matthias, C., & Hagemann, J. (2020). A new form of irritant rhinitis to filtering facepiece particle (FFP) masks (FFP2/N95/KN95 respirators) during COVID-19 pandemic. The World Allergy Organization journal, 13(10), 100474. https://doi.org/10.1016/j.waojou.2020.100474

Korean Centre for Disease Control. (2020). Infection prevention and control for novel coronavirus infection. https://cheongju.go.kr/www/selectBbsNttView.do?key=280&bbsNo=510&nttNo=145181&integrDeptCode=000100101

Kuo, F. L., Yang, P. H., Hsu, H. T., Su, C. Y., Chen, C. H., Yeh, I. J., Wu, Y. H., & Chen, L. C. (2020). Survey on perceived work stress and its influencing factors among hospital staff during the COVID-19 pandemic in Taiwan. The Kaohsiung journal of medical sciences, 36(11), 944–952. https://doi.org/10.1002/kjm2.12294

Lai X, Wang M, Qin C, Tan L, Ran L, Chen D, et al. (2020). Coronavirus Disease 2019 (COVID-2019) Infection Among Health Care Workers and Implications for Prevention Measures in a Tertiary Hospital in Wuhan, China. *JAMA Network Open*, e209666–e209666. https://doi.org/10.1001/jamanetworkopen.2020.9666

Lau D, Majumdar SR & McAlister FA. (2016). Patient isolation precautions and 30-day risk of readmission or death after hospital discharge: a prospective cohort study. International Journal of Infectious Diseases, 43, 74-76. https://doi.org/10.1016/j.ijid.2015.12.018, 10.1016/j.ijid.2015.12.018

Lawrence, R. J., O'Donoghue, G., Kitterick, P., O'Donoghue, K., Hague, R., Mitchell, L., Lycett-Ranson, Z., & Hartley, D. (2020). Recommended personal protective equipment for cochlear implant and other mastoid surgery during the COVID-19 era. The Laryngoscope, 10.1002/lary.29014. Advance online publication. https://doi.org/10.1002/lary.29014

Lee, J., Venugopal, V., Latha, P. K., Alhadad, S. B., Leow, C., Goh, N. Y., Tan, E., Kjellstrom, T., Morabito, M., & Lee, J. (2020). Heat Stress and Thermal Perception amongst Healthcare Workers during the COVID-19 Pandemic in India and Singapore. International journal of environmental research and public health, 17(21), 8100. https://doi.org/10.3390/ijerph17218100

Lessells, R., Moosa, Y., de Oliveira, T. Report into a nosocomial outbreak of coronavirus disease 2019 (COVID-19) at Netcare St. Augustine's Hospital. 15 May 2020. Accessed 20 November 2020. https://www.krisp.org.za/manuscripts/StAugustinesHospitalOutbreakInvestigation_FinalReport_15may2020_comp.pdf

Leung N.H.L, Chu D.K.W., Shiu E.Y.C., et al. Respiratory virus shedding in exhaled breath and efficacy of face masks. Nature Med 2020; 26: 676-680. https://www.nature.com/articles/s41591-020-0843-2

Li, Y., Cen X., Cai, X., Temkin-Greener, H. (2020). Racial and Ethnic Disparities in COVID-19 Infections and Deaths Across U.S. Nursing Homes. J Am Geriatr Soc 21 September 2020. Epub ahead of print. https://doi.org/10.1111/jgs.16847

Li, Y., Temkin-Greener, H., Shan, G., Cai, X. (2020). COVID-19 Infections and Deaths among Connecticut Nursing Home Residents: Facility Correlates. Journal of the American Geriatrics Society, 68(9), 1899-1906.

Liang, M., Gao L, Cheng, C. Zhou, Q., Uy, J.P., Heiner, K., Sun, C. Efficacy of face mask in preventing respiratory virus transmission. A systematic review and meta-analysis. Travel Med Infect Dis 2020; 36:101751. https://doi.org/10.1016/j.tmaid.2020.101751

Lidström A-K, Sund F, Albinsson B, Lindbäck J, Westman G, Lidstrom A-K, et al. (2020). Work at inpatient care units is associated with an increased risk of SARS-CoV-2 infection; a cross-sectional study of 8679 healthcare workers in Sweden. *Upsala Journal of Medical Sciences*, 125(4):305–10. https://doi.org/10.1080/03009734.2020.1793039

Lim, E. C., Seet, R. C., Lee, K. H., Wilder-Smith, E. P., Chuah, B. Y., & Ong, B. K. (2006). Headaches and the N95 face-mask amongst healthcare providers. Acta neurologica Scandinavica, 113(3), 199–202. https://doi.org/10.1111/j.1600-0404.2005.00560.x

Lin, P., Zhu, S., Huang, Y., Li, L., Tao, J., Lei, T., Song, J., Liu, D., Chen, L., Shi, Y., Jiang, S., Liu, Q., Xie, J., Chen, H., Duan, Y., Xia, Y., Zhou, Y., Mei, Y., Zhou, X., Wu, J., … Li, H. (2020). Adverse skin reactions among healthcare workers during the coronavirus disease 2019 outbreak: a survey in Wuhan and its surrounding regions. The British journal of dermatology, 183(1), 190–192. https://doi.org/10.1111/bjd.19089

Lipsitz, L.A., Lujan, A.M., Dufour, A., Abrahams, G., Magliozzi, H., Herndon, L., & Dar, M. (2020). Stemming the Tide of COVID-19 Infections in Massachusetts Nursing Homes. Journal of the American Geriatrics Society, Epub ahead of print. https://doi.org/10.1111/jgs.16832

Loeb M, Dafoe N, Mahony J, *et al*. Surgical mask vs N95 respirator for preventing influenza among health care workers: a randomized trial. *JAMA* 2009;302:1865–71. doi:10.1001/jama.2009.1466

Loeb M, McGeer A, Henry B, *et al*. Sars among critical care nurses, Toronto. *Emerg Infect Dis* 2004;10:251–5. https://dx.doi.org/10.3201%2Feid1002.030838

MacIntyre_CR, Wang_Q, Cauchemez_S, Seale_H, Dwyer_DE,Yang_P, et al. A cluster randomized clinical trial comparing fit-tested
and non-fit-tested N95 respirators to medical masks to prevent respiratory virus infection in health care workers. *Influenza and Other Respiratory Viruses* 2011;**5**(3):170–9.

MacIntyre_CR, _Wang_Q, _Seale_H, _Yang_P, _Shi_W, _Gao_Z, et al. A randomized clinical trial of three options for N95 respirators
and medical masks in health workers. *American Journal of)Respiratory and)Critical Care Medicine* 2013;**187**(9):960-6. [DOI: 10.1164/rccm.201207-1164OC]

MacIntyre_CR, _Seale_H, _Dung_TC, _Hien_NT, _Nga_PT, Chughtai_AA, et al. A cluster randomised trial of cloth masks compared with medical masks in healthcare workers. *BMJ Open* 2015;**5**(4):e006577.

MacIntyre C.R., Chughtai A.A. A rapid systematic review of the efficacy of face masks and respirators against coronaviruses and other respiratory transmissible viruses for the community, healthcare workers and sick patients. Int J Nurs Stud 2020: 103629. https://doi.org/10.1016/j.ijnurstu.2020.103629

MacIntyre, C.R. , Zhang, Y. , Chughtai, A .A . , Seale, H. , Zhang, D. , Chu, Y. , et al.
, 2016. Cluster randomised controlled trial to examine medical mask use as source control for people with respiratory illness. BMJ Open 6 (12), e012330. http://dx.doi.org/10.1136/bmjopen-2016-01233

Martin CA, Patel P, Goss C, Jenkins DR, Price A, Barton L, et al. (2020). Demographic and occupational determinants of anti-SARS-CoV-2 IgG seropositivity in hospital staff. *Journal of Public Health (Oxf),* fdaa199. https://doi.org/10.1093/pubmed/fdaa199

Morgan DJ, Day HR, Harris AD, Furuno JP & Perencevich EN. (2011). The impact of Contact Isolation on the quality of inpatient hospital care. PLoS ONE [Electronic Resource], 6, e22190. https://doi.org/10.1371/journal.pone.0022190, 10.1371/journal.pone.0022190

Mortgat L, Barbezange C, Fischer N, Heyndrickx L, Hutse V, Thomas I, et al. (2020). SARS-CoV-2 Prevalence and Seroprevalence among Healthcare Workers in Belgian Hospitals: Baseline Results of a Prospective Cohort Study. https://doi.org/10.1101/2020.10.03.20204545

Moscola J, Sembajwe G, Jarrett M, et al. (2020). Prevalence of SARS-CoV-2 antibodies in health care personnel in the New York City area. *JAMA*, 324: 893-895. https://doi.org/10.1001/jama.2020.14765

National Collaborating Centre for Methods and Tools. What risk factors are associated with COVID-19 outbreaks and mortality in long-term care facilities and what strategies mitigate risk? (2020, October 16). Access 30 November 2020. https://www.nccmt.ca/knowledge-repositories/covid-19-rapid-evidence-service

New Zealand Ministry of Health. (2020). Personal Protective Equipment (PPE) for staff caring for COVID-19 patients in hospital. https://www.health.govt.nz/our-work/diseases-and-conditions/covid-19-novel-coronavirus/covid-19-information-specific-audiences/covid-19-personal-protective-equipment-workers/personal-protective-equipment-use-health-and-disability-care-settings

Ng K, Poon B, Kiat Puar T, *et al*. COVID-19 and the risk to health care workers: a case report. *Ann Intern Med* 2020. https://doi.org/10.7326/l20-0175

Olayanju O, Bamidele O, Edem F, Eseile B, Amoo A, Nwaokenye J, et al. (2020). SARS-CoV-2 Seropositivity in Asymptomatic Frontline Health Workers in Ibadan, Nigeria. *American Journal of Tropical Medicine and Hygiene*. https://doi.org/10.4269/ajtmh.20-1235

Ong, J. J., Bharatendu, C., Goh, Y., Tang, J. Z., Sooi, K. W., Tan, Y. L., ... & Sharma, V. K. (2020). Headaches associated with personal protective equipment–A cross-sectional study among frontline healthcare workers during COVID-19. Headache: The Journal of Head and Face Pain, 60(5), 864-877. https://headachejournal.onlinelibrary.wiley.com/doi/pdf/10.1111/head.13811

Ontario Health. (2020). Infection Prevention and Control (IPAC) for Scheduled Surgeries and Procedures During the COVID-19 Pandemic. https://www.ontariohealth.ca/sites/ontariohealth/files/2020-06/COVID-19%20Infection%20Prevention%20and%20Control%20for%20Scheduled%20Surgeries%20and%20Procedures_8June2020.pdf

Ontario Health. (2020). Personal Protective Equipment (PPE) Use During the COVID-19 Pandemic. https://www.ontariohealth.ca/sites/ontariohealth/files/2020-05/Ontario%20Health%20Personal%20Protective%20Equipment%20Use%20During%20the%20COVID-19%20Pandemic_rev10May20%20PDF_v2.pdf

Palinkas, L. A., Whiteside, L., Nehra, D., Engstrom, A., Taylor, M., Moloney, K., & Zatzick, D. F. (2020). Rapid ethnographic assessment of the COVID-19 pandemic April 2020 'surge' and its impact on service delivery in an Acute Care Medical Emergency Department and Trauma Center. BMJ open, 10(10), e041772. https://doi.org/10.1136/bmjopen-2020-041772

Park SH. (2020). Personal Protective Equipment for Healthcare Workers during the COVID-19 Pandemic. *Infection & Chemotherapy*, 52(2):165-182. https://doi.org/10.3947/ic.2020.52.2.165

Parush, A., Wacht, O., Gomes, R., & Frenkel, A. (2020). Human Factor Considerations in Using Personal Protective Equipment in the COVID-19 Pandemic Context: Binational Survey Study. Journal of medical Internet research, 22(6), e19947. https://doi.org/10.2196/19947

Pei, S., Xue, Y., Zhao, S., Alexander, N., Mohamad, G., Chen, X., & Yin, M. (2020). Occupational skin conditions on the front line: a survey among 484 Chinese healthcare professionals caring for Covid-19 patients. Journal of the European Academy of Dermatology and Venereology : JEADV, 34(8), e354–e357. https://doi.org/10.1111/jdv.16570

Perna, G., Cuniberti, F., Daccò, S., Nobile, M., & Caldirola, D. (2020). Impact of respiratory protective devices on respiration: Implications for panic vulnerability during the COVID-19 pandemic. Journal of affective disorders, 277, 772–778. https://doi.org/10.1016/j.jad.2020.09.015

Piapan L, De Michieli P, Ronchese F, et al. (2020) COVID-19 outbreak in healthcare workers in Trieste hospitals (North–Eastern Italy). *Journal of Hospital Infections*, 106(3): 626–628. https://doi.org/10.1016/j.jhin.2020.08.012

Pineles L, Petruccelli C, Perencevich EN, Roghmann MC, Gupta K, Cadena J, et al. (2018). The Impact of Isolation on Healthcare Worker Contact and Compliance With Infection Control Practices in Nursing Homes. Infection Control & Hospital Epidemiology, 39, 683-687. https://doi.org/10.1017/ice.2018.50, 10.1017/ice.2018.50

Porru S, Carta A, Monaco MGL, Verlato G, Battaggia A, Parpaiola M, et al. (2020). Health Surveillance and Response to SARS-CoV-2 Mass Testing in Health Workers of a Large Italian Hospital in Verona, Veneto. *International Journal of Environmental Research and Public Health*, 17(14): 5104. https://doi.org/10.3390/ijerph17145104

Public Health Agency of Canada (PHAC). (2020). COVID-19 technical brief: Masking and face shields for full duration of shifts in acute healthcare settings. https://www.canada.ca/en/public-health/services/diseases/2019-novel-coronavirus-infection/health-professionals/technical-brief-masking-face-shields-full-duration-shifts-acute-healthcare-settings.html

Public Health Agency of Canada (PHAC). (2020). Infection prevention and control for COVID-19: Second interim guidance for acute healthcare settings. https://www.canada.ca/en/public-health/services/diseases/2019-novel-coronavirus-infection/health-professionals/infection-prevention-control-covid-19-second-interim-guidance.html#a8.7

Public Health Agency of Canada (PHAC). (2020). Infection prevention and control for COVID-19: Interim guidance for long term care homes. https://www.canada.ca/en/public-health/services/diseases/2019-novel-coronavirus-infection/prevent-control-covid-19-long-term-care-homes.html

Public Health Ontario. (2020). IPAC Recommendations for Use of Personal Protective Equipment for Care of Individuals with Suspect or Confirmed COVID 19. https://www.publichealthontario.ca/-/media/documents/ncov/updated-ipac-measures-covid-19.pdf?la=en

Purssell, E., Gould, D., & Chudleigh, J. (2020). Impact of isolation on hospitalised patients who are infectious: systematic review with meta-analysis. BMJ open, 10(2), e030371. https://doi.org/10.1136/bmjopen-2019-030371

Purushothaman, P. K., Priyangha, E., & Vaidhyswaran, R. (2020). Effects of Prolonged Use of Facemask on Healthcare Workers in Tertiary Care Hospital During COVID-19 Pandemic. Indian journal of otolaryngology and head and neck surgery : official publication of the Association of Otolaryngologists of India, 1–7. Advance online publication. https://doi.org/10.1007/s12070-020-02124-0

Ribeiro, V. V., Dassie-Leite, A. P., Pereira, E. C., Santos, A., Martins, P., & Irineu, R. A. (2020). Effect of Wearing a Face Mask on Vocal Self-Perception during a Pandemic. Journal of voice : official journal of the Voice Foundation, S0892-1997(20)30356-8. Advance online publication. https://doi.org/10.1016/j.jvoice.2020.09.006

Rickman H.M., Rampling, T., Shaw, K., et al. Nosocomial transmission of Coronavirus Disease 2019: a retrospective study of 66 hospital-acquired cases in a London teaching hospital. Clin Infect Dis 2020 June 2020: ciaa816. https://dx.doi.org/10.1093%2Fcid%2Fciaa816

Saint, S., Higgins, L. A., Nallamothu, B. K., & Chenoweth, C. (2003). Do physicians examine patients in contact isolation less frequently? A brief report. American journal of infection control, 31(6), 354–356. https://doi.org/10.1016/s0196-6553(02)48250-8

Samaranayake, L.P., Fakhruddin, K.S., Ngo, H.C., Chang, J.W.W, Panduwawala, C. The effectiveness and efficacy of respiratory protective equipment (RPE) in dentistry and other health care settings: a systematic review. Acta Odontologica Scandinavica, 78:8, 626-639, DOI: 10.1080/00016357.2020.1810769

Saskatchewan Health Authority. (2020). Continuous and Extended Use PPE Guidelines when caring for Patients Suspected or confirmed to have COVID-19 in Acute Care. https://www.saskhealthauthority.ca/news/service-alerts-emergency-events/covid-19/PPE-infection-prevention-control/Documents/Personal%20Protective%20Equipment/Recommendations/CV-19-G0006-Continuous-and-Extended-PPE-Use-Guidelines-Acute-Care.pdf

Saskatchewan Health Authority. (2020). Continuous and Extended Use PPE Guidelines when caring for Patients Suspected or confirmed to have COVID-19 in Continuing Care. https://www.saskhealthauthority.ca/news/service-alerts-emergency-events/covid-19/PPE-infection-prevention-control/Documents/Personal%20Protective%20Equipment/Recommendations/CV-19-G0007-Continuous-and-Extended-PPE-Use-Guidelines-Continuing-Care.pdf

Saskatchewan Health Authority. (2020). Continuous and Extended Use PPE Guidelines when caring for Patients confirmed to have COVID-19 in Designated Units/Rooms. https://www.saskhealthauthority.ca/news/service-alerts-emergency-events/covid-19/PPE-infection-prevention-control/Documents/Personal%20Protective%20Equipment/Recommendations/CV19G0038PPEGuidelinesWhenCaringforPatientsResidentsConfirmedtohaveCOVID19inDesignatedUnitsCohortedS.pdf

Saskatchewan Health Authority. (2020). Infection Prevention and Control Masking Guidelines for Patients. https://www.saskhealthauthority.ca/news/service-alerts-emergency-events/covid-19/PPE-infection-prevention-control/Documents/Personal%20Protective%20Equipment/Recommendations/CV-19-G0043-Masking-Guidelines-for-Patients-Residents-Clients.pdf

Seidelman JL, Lewis SS, Advani SD, et al. (2020). Universal masking is an effective strategy to flatten the severe acute respiratory coronavirus virus 2 (SARS-CoV-2) healthcare worker epidemiologic curve. Infection Control & Hospital Epidemiology, 41: 1466–1467, https:// doi.org/10.1017/ice.2020.313

Shack, A. R., Arkush, L., Reingold, S., & Weiser, G. (2020). Masked paediatricians during the COVID-19 pandemic and communication with children. Journal of paediatrics and child health, 56(9), 1475–1476. https://doi.org/10.1111/jpc.15087

Shared Health Manitoba. (2020). Provincial Requirements for Personal Protective Equipment (PPE). https://sharedhealthmb.ca/files/covid-19-provincial-ppe-requirements.pdf

Shen, K. (2020). Relationship between nursing home COVID-19 outbreaks and staff neighborhood characteristics. Preprint. https://doi.org/10.1101/2020.09.10.20192203

Shi, S.M., Bakaev, I., Chen, H., Travison, T.G, & Berry, S.D. (2020). Risk Factors, Presentation, and Course of Coronavirus Disease 2019 in a Large, Academic Long-Term Care Facility. The Journal of Post-Acute and Long-Term Care Medicine, 21(10), 1378-1383.

Shields A, Faustini SE, Perez-Toledo M, Jossi S, Aldera E, Allen JD, et al. (2020). SARS-CoV-2 seroprevalence and asymptomatic viral carriage in healthcare workers: a cross-sectional study. *Thorax*, 75:1089-1094. http://dx.doi.org/10.1136/thoraxjnl-2020-215414

Sikkema R.S., Pas, S.D., Nieuwenhuijse, D.F., O'Toole, A., et al. COVID-19 in health-care workers in three hospitals in the south of the Netherlands: a cross-sectional study. Lancet Infect Di 2020; 20:1273-80. https://doi.org/10.1016/ S1473-3099(20)30527-2

Spence MR & McQuaid M. (2011). The interrelationship of isolation precautions and adverse events in an acute care facility. American Journal of Infection Control, 39, 154-5. https://doi.org/10.1016/j.ajic.2010.04.213, 10.1016/j.ajic.2010.04.213

Stall, N., Jones, A., Brown, K., Rochon, P., & Costa, A. (2020). For-profit long-term care homes and the risk of COVID-19 outbreaks and resident deaths. Canadian Medical Association Journal, 192(33), E946–E955.

Stelfox HT, Bates DW & Redelmeier DA. (2003). Safety of patients isolated for infection control. JAMA, 290, 1899-905. https://doi.org/10.1001/jama.290.14.1899

Sugg, M., Spaulding, T., Lane, S., Runkle, J., Harden, S., Hege, A., & Iyer, L. (2020). Mapping community-level determinants of COVID-19 transmission in nursing homes: A multi-scale approach. The Science of the Total Environment , 752, 141946.

Tabah, A., Ramanan, M., Laupland, K. B., Buetti, N., Cortegiani, A., Mellinghoff, J., Conway Morris, A., Camporota, L., Zappella, N., Elhadi, M., Povoa, P., Amrein, K., Vidal, G., Derde, L., Bassetti, M., Francois, G., Ssi Yan Kai, N., De Waele, J. J., & PPE-SAFE contributors (2020). Personal protective equipment and intensive care unit healthcare worker safety in the COVID-19 era (PPE-SAFE): An international survey. Journal of critical care, 59, 70–75. https://doi.org/10.1016/j.jcrc.2020.06.005

Tan NC, Goh LG & Lee SS. (2006). Family physicians' experiences, behaviour, and use of personal protection equipment during the SARS outbreak in Singapore: do they fit the Becker Health Belief Model?. Asia-Pacific Journal of Public Health, 18, 49-56. https://doi.org/10.1177/10105395060180030901

Teh, K., Tay, S. W., Chen, K., Koh, S. J., Wong, Y. J., Kwek, A., Li, J. W., Fock, K. M., Teo, E. K., Ang, T. L., & Tan, M. (2020). Impact of enhanced personal protective equipment on colonoscopy performance during the COVID-19 pandemic. Endoscopy international open, 8(6), E809–E814. https://doi.org/10.1055/a-1167-1703

Temkin-Greener, H., Guo, W., Mao, Y., Cai, X., & Li, Y. (2020). COVID-19 Pandemic in Assisted Living Communities: Results from Seven States. J Am Geriatr Soc. 21 September 2020. Epub ahead of print. https://doi.org/10.1111/jgs.16850

Tran K, Bell C, Stall N, Tomlinson G, McGeer A, Morris A, et al. (2017). The Effect of Hospital Isolation Precautions on Patient Outcomes and Cost of Care: A Multi-Site, Retrospective, Propensity Score-Matched Cohort Study. Journal of General Internal Medicine, 32, 262-268. https://doi.org/10.1007/s11606-016-3862-4, 10.1007/s11606-016-3862-4

Vancouver Coastal Health. (2020). PPE Recommendations – Acute. For health-care personnel participating in patient care during the COVID-19 Pandemic. http://ipac.vch.ca/Documents/COVID-19/Dress%20Codes%20and%20PPE/PPE_Recommendations_%28Acute%29_V2.pdf

Vancouver Coastal Health. (2020). PPE Recommendations – Community. http://ipac.vch.ca/Documents/COVID-19/Dress%20Codes%20and%20PPE/PPE_Recommendations_%28Community%29.pdf

Verbeek, J.H., Rajamaki, B., Ijaz, S. et al. Personal protective equipment for preventing highly infectious diseases due to exposure to contaminated body fluids in healthcare staff (review). *Cochrane Database of Systematic Reviews* 2020, Issue 5. Art. No.: CD011621. DOI: 10.1002/14651858.CD011621.pub5.

Wang X, Ferro EG, Zhou G et al. Association between universal masking in a health care system and SARS-CoV-2 positivity among health care workers. JAMA 2020; 324(7):703-704. doi:10.1001/jama.2020.12897

Wassenberg MW, Severs D & Bonten MJ. (2010). Psychological impact of short-term isolation measures in hospitalised patients. Journal of Hospital Infection, 75, 124-7. https://doi.org/10.1016/j.jhin.2010.01.023, 10.1016/j.jhin.2010.01.023

Wei J-T, Liu Z-D, Fan Z-W, Zhao L, Cao W-C. (2020). Epidemiology of and Risk Factors for COVID-19 Infection among Health Care Workers: A Multi-Centre Comparative Study. *International Journal of Environmental Research and Public Health*, 17(19):7149. https://doi.org/10.3390/ijerph17197149

White, E., Kosar, C., Feifer, R., Blackman, C., Gravenstein, S., Ouslander, J., & Mor, V. (2020). Variation in SARS-CoV -2 Prevalence in U.S. Skilled Nursing Facilities. Journal of the American Geriatrics Society. Epub ahead of print.

World Health Organization (WHO). (2020). Mask use in the context of COVID-19. 1 December 2020. https://apps.who.int/iris/bitstream/handle/10665/337199/WHO-2019-nCov-IPC_Masks-2020.5-eng.pdf?sequence=1&isAllowed=y

World Health Organization (WHO). (2020). Infection prevention and control during health care when coronavirus disease (COVID-19) is suspected or confirmed. https://www.who.int/publications/i/item/WHO-2019-nCoV-IPC-2020.4

World Health Organization (WHO). (2020). Infection Prevention and Control guidance for Long-Term Care Facilities in the context of COVID-19. https://apps.who.int/iris/handle/10665/331508

World Health Organization (WHO). (2020). Rational use of personal protective equipment for coronavirus disease (COVID-19) and considerations during severe shortages. https://www.who.int/publications/i/item/rational-use-of-personal-protective-equipment-for-coronavirus-disease-(covid-19)-and-considerations-during-severe-shortages

Yánez Benítez, C., Güemes, A., Aranda, J., Ribeiro, M., Ottolino, P., Di Saverio, S., Alexandrino, H., Ponchietti, L., Blas, J. L., International Cooperation Group on PPE and Emergency Surgery, Ramos, J. P., Rangelova, E., Muñoz, M., & Yánez, C., Sr (2020). Impact of Personal Protective Equipment on Surgical Performance During the COVID-19 Pandemic. World journal of surgery, 44(9), 2842–2847. https://doi.org/10.1007/s00268-020-05648-2

Yin, J., Schweizer, M. L., Herwaldt, L. A., Pottinger, J. M., & Perencevich, E. N. (2013). Benefits of universal gloving on hospital-acquired infections in acute care pediatric units. Pediatrics, 131(5), e1515–e1520. https://doi.org/10.1542/peds.2012-3389

Zamora JE, Murdoch J, Simchison B, Day AG. Contamination: a comparison of 2 personal protective systems. CMAJ: Canadian Medical Association journal = journal de l'Association medicale canadienne. 2006;175(3):249–54.

Zhang, M., Emery, A.R., Tannyhill III, R.J., Zheng, H., Wang, J. Masks of N95 respirators during COVID-19 pandemic- which one should I wear? J Oral Maxillofac Surg 2020:1-4. https://doi.org/10.1016/j.joms.2020.08.024

Zhang, X.S., Duchaine, C. SARS-CoV-2 and health care worker protection in low-risk settings: a review of modes of transmission and a novel airborne model involving inhalable particles. Clin Micro Rev 2021; 34(1):e00184-20. https://doi.org/10.1128/CMR.00184-20

Zhou, Q., Gao, Y., Wang, X., et al. Nosocomial infections among patients with COVID-19, SARS and MERS: a rapid review and meta-analysis. *Ann Transl Med* 2020; 8(10):629-639. http://atm.amegroups.com/article/view/42877/html