Scientific Advisory Group

COVID-19 Scientific Advisory Group Rapid Evidence Report

Continuous Masking Policies

4 July 2022

Alberta Health Services

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Lay Summary

BACKGROUND

As of June 2022 with lifting of provincial public health orders, AHS is responsible for setting indoor mask policies within healthcare facilities.

Continuous mask policies have been widely implemented in healthcare settings as part of a group of actions intended to reduce the risk of COVID-19 spread in hospitals and among healthcare workers

Masking in hospitals is a core part of personal protective equipment and data suggests continuous masking may be helpful during COVID-19 surges however, continuous masking may have some unwanted physical, emotional, and communication effects as well as environmental, and financial implications that should be considered.

This review is intended to provide information to AHS decision-makers who are setting AHS policies for continuous masking in healthcare settings.

KEY MESSAGES

The evidence identified in this review cannot definitively show specific effect of continuous masking which started at the same time as multiple protective measures healthcare settings, and the level of evidence is not strong. However, the studies all showed similar findings which support continuous masking was associated with a decreased risk of COVID-19 infection in hospitals.

Looking at practices across Canada, all other Canadian provinces currently have maintained mask policies in healthcare settings regardless of provincially public health mandate removal. Criteria or rationale for changing mask requirements in healthcare settings are suggested in documents from Ontario and Nova Scotia.

The committee suggested that mask policies and policies for other measures should be reassessed as the pandemic evolves. For example, a process which considers the data (which is limited) on the absolute benefit of continuous masking over situational masking, the presence and impact of other respiratory illnesses and healthcare strain related should be developed.

RECOMMENDATIONS

The evidence overall suggests that continuous masking is likely beneficial in reducing healthcare setting-based transmission; however, the absolute benefit of a continuous or universal masking policy is dependent upon the absolute risk and consequences of infection. The modification of a mask policy (implementation or withdrawal) should be considered in the context of other factors such as the other measures that remain in place, and formally tracked epidemiologic risk indicators that will inform modification of masking and other healthcare respiratory virus control policies.

Since the available evidence does not provide a definitive guidance on use or non-use of continuous masking specific to the current and evolving context, specific options and caveats for modifying the AHS masking policy are available in the Practical Guidance section of this report.

Authorship and Committee Members

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Topic: Impact of Continuous Masking in Healthcare Facilities

1. **What is the impact of continuous masking policies (compared with no continuous masking) on the number of facility outbreaks, and on in-hospital transmission to patients and staff in acute care settings?**
2. **What are other organizations in Canada doing with respect to continuous masking in healthcare facilities (both acute care and long-term care?)**

Context

As public health orders, including masking requirements, across Canada are rescinded due to rapidly declining prevalence and severity of COVID-19 (as of June 2022), it is prudent to consider the impact of continuous staff masking to reduce the risk of COVID-19 transmission within healthcare facilities.

Most healthcare systems implemented continuous masking policies as part of a bundle of interventions to try to reduce transmission of COVID-19 in health care settings; masking may also impact other respiratory virus transmission.

The context of COVID-19 community transmission has evolved since mask policies were originally designed and implemented in 2020:

- There has been recent widespread Omicron transmission despite existing measures and current vaccination levels, with sustained COVID-19 vaccine effectiveness against severe consequences including hospitalization, but reduced protection against infection.
- Compliance with personal protective equipment (PPE) protocols is felt to have decreased, potentially related to individual fatigue and perception of importance, and reports that some HCW are relying on vaccination without recognizing increased Omicron infection risk.
- The potential impact of new, potentially more transmissible VOCs (particularly Omicron BA.4 and BA.5), as well as potential waning vaccine effectiveness or divergence between circulating COVID-19 strain and vaccine effectiveness, on both community and healthcare burden of COVID-19 over the summer and fall is still unclear.

Continuous masking could have physical impacts on individuals as well as non-physical impacts on inter-personal communication and the emotional elements of patient care (see previous SAG review identifying evidence to support continuous masking policies, SAG review identifying the potential harms of masks, and SAG review on other potential risks of masks). This is a concern particularly in populations with communication challenges (such as the elderly, those with communication disorders, or in addictions and mental health), where lip reading and/or interpreting facial non-verbal cues is a prominent part of communication. Conversely, masking policies may also provide reassurance to patients, families, and staff who are anxious about coming into healthcare settings. The optics of a universal mask policy may be significant, as a face mask can serve as a reminder of the risks of respiratory viruses; that other risk mitigation activities

should continue (such as hand hygiene, physical distancing, and self-monitoring for symptoms); and that AHS is invested in the physical and psychological safety of their staff.

There are both environmental and monetary costs to consider in continuous masking assessment, as staff members require multiple masks per shift. Over the life cycle of the product, masks and respirators are a source of energy consumption, greenhouse gas emissions, and polypropylene pollution (Atılgan Türkmen, 2022; Du, Huang & Wang, 2022; United Nations Environment Programme, 2022).

In the past month (May 15 – June 14 2022), nearly $4 million was spent on masks that were distributed to AHS sites, contracted providers, and third parties. This accounts for 8,474,608 masks, although does not reflect exact usage over this time period (personal communication).

As of June 2022, with lifting of provincial public health orders, AHS is responsible for setting indoor mask policies within healthcare facilities. This review is intended to provide information to AHS decision-makers who are setting AHS policies for continuous masking in healthcare settings.

Terminology and Definitions

AHS uses the term “continuous masking” to refer to the organizational Use of Masks Directive (HCS-267; updated March 22, 2022). In this policy, AHS People (anyone who provides care or services, or who acts on behalf of AHS) are required to wear a mask at all times in all areas of an AHS facility (clinical or non-clinical) while providing patient care, working in patient care areas, or performing job duties. Inpatients are not required to wear a mask in their bed space but must continuously mask when outside of their bed space. The AHS PPE policy for visitors (updated March 25, 2022) mirrors the policy for AHS People.

The Directive differentiates between clinical areas, non-clinical areas within facilities where care is provided (i.e. no direct contact with patients or patient items) and administrative settings where no care is provided.

The literature largely uses “universal masking” to refer to policies where staff and visitors are mandated to wear a well-fitting face covering (eg. surgical mask or N95 respirator) at all times in the facility, but patients are obligated to wear a mask when out of their rooms or when others (staff or visitors) are in the room.

For the purposes of this review, ‘universal masking’ and ‘continuous masking’ are used interchangeably.

Key Messages from the Evidence Summary

Assessed literature and documents:

The body of primary evidence around the impact of continuous masking is of very low to low quality as there are no controlled studies, only observational studies and retrospective surveys. The evidence that was identified in the database search is highly confounded and at high risk of bias; however, consistency of direction of effect (benefit) was noted.

Twenty-two primary articles were identified for inclusion in this review and policy information for the jurisdictional scan was gathered from Canadian provincial and territorial healthcare organizations.

Key messages from the primary literature review:

The methods used are insufficient to definitively show the effect of continuous masking policies as an isolated infection prevention and control (IPC) measure in hospital settings. No controlled studies were identified, and the observational studies are at high risk of bias due to confounding with concurrent “bundled” IPC measures and infection prevention behaviours by healthcare workers (HCWs). Retrospective studies using a survey methodology to determine PPE compliance are at risk of recall bias and social desirability bias.

Despite the quality shortcomings of the identified evidence, findings were consistent, which increases confidence in the findings. All included studies suggested that the implementation of a continuous masking policy, with or without an accompanying suite of IPC measures, was associated with decreased risk of infection for HCWs and patients. The literature largely uses ‘universal masking’ to refer to policies where staff and visitors are mandated to wear a well-fitting face covering (eg. surgical mask or N95 respirator) at all times in the facility, and patients are obligated to wear a mask when out of their rooms or when others (staff or visitors) are in the room.

All of the included primary studies on continuous masking policies were conducted at the beginning of the pandemic, largely between February and May 2020. The generalizability of findings may be reduced by the behavioural differences in individuals at the beginning of the pandemic compared to now; the lack of data post-COVID vaccination; and presence of new variants of concern (which may impact the effectiveness of masking), as both the personal risk of severe infection has decreased with vaccination, and the impact of preventative measures apparently diluted.

Five studies were identified that suggested increased odds of occupational COVID-19 infection in healthcare settings were associated with poor PPE compliance (in non-COVID-19 units) or staff interactions outside of patient care

spaces (e.g. breakroom, classrooms, or office spaces). COVID-19 infection was also more strongly associated with community or home transmission than with occupational transmission. Anecdotal observations from Alberta suggest that HCW-patient transmission of COVID-19 is more likely to occur due to breaches in mask continuity for the purposes of source control (as opposed to personal protection) (personal communication).

In some cases, working on a COVID-19 unit (compared with non-COVID-19 units) was protective against infection and thought to be due to the consistent PPE and high standards of compliance, supporting the conclusion that even in high-risk health care settings, PPE compliance is protective against transmission of COVID-19.

Three studies showed that continuous mask policies were associated with a reduction in incident COVID-19 among HCWs, even while community rates were rising. While these studies are at high risk of bias and confounding, case positivity and incidence rates for COVID-19 decreased specifically among HCWs, while the rates continued to increase in the community after the introduction of universal mask policies. The best example is Lan (2020), where the slope in incident rates over time in HCW and community overlapped in the pre-intervention period (0.96 and 0.99, respectively), decreased for HCWs but not community in the post-intervention period (-0.68 and 0.99, respectively); and overlapped again for both HCWs and community during the epidemic decline (-0.90 and -0.99, respectively).

Results from the jurisdictional scan:

Currently all Canadian provinces have removed mask mandates in public spaces, although most provide exceptions for health care settings, long-term care, and other settings with vulnerable persons (Alberta, Manitoba, Northwest Territories, Nunavut, Saskatchewan, and Yukon do not specify an exception for healthcare settings). Ontario has removed all mask mandates, however individual health care organizations have established their own mask policies for visitors, patients and staff. In Alberta, healthcare masking policy has shifted to an organizational policy by Alberta Health Services.

There is limited evidence in the jurisdictional scan that provides specific information regarding the criteria or rationale for changing mask mandate in healthcare settings. Nova Scotia provides a four-tier tool based upon community risk level, staff absences, admissions, hospitalizations and health care risk-HCW vaccine uptake (although it has not been validated). This risk assessment outlines mask protocols in a variety of healthcare settings (such as inpatient units, break rooms, waiting rooms, etc.) based upon the perceived risk at the time.

Mask mandates have been lifted in most international jurisdictions, although some persist. Most commonly, existing mask mandates focus on confined spaces (such as transit) and health care settings, or settings in which vulnerable individuals may reside. It is unclear if they have affected COVID-19 incidence rates in these settings.

Commentary and Expert Opinion on Evidence Summary

The benefit of masks cannot be definitively determined from existing evidence, as masking is often studied within a bundle of other IPC interventions, and there is an absence of randomized trials (the most rigorous study design). However, the consistency of the evidence, in context of other information on transmissibility, indicates that continuous or universal masking in health care settings is associated with a reduction of transmission of the respiratory virus COVID-19.

The benefit of continuous masking in health care settings will be influenced by both the absolute risk of transmission (lower risk with lower prevalence); the degree of protection against transmission of specific variants; the degree of vaccination among patients and HCWs and vaccine effectiveness against infection (versus against severe outcomes) and the consequences to those at risk of infection (staff absenteeism, severity in immunocompromised persons). No evidence was identified regarding the cost-effectiveness of universal mask policies.

There are other considerations and contextual factors that inform the decision to implement, modify, or withdraw a universal masking policy in healthcare settings. These have been reported and discussed in previous SAG reviews but are summarized here:

- Continuous masking may be associated with some (usually small) physical harms to the wearer and potential emotional and psychosocial harms due to the communication barriers and impact on the therapeutic relationship (Lee, Cormier & Sharma, 2022; Chu et al., 2021).; AHS Scientific Advisory Group, 2020). However, the experience over the last 27 months is that continuous masking policies have been functional and broadly acceptable when there is demonstrated need.
- Although they may not be strictly required from an IPC perspective, mask policies may improve or maintain the perception that the organization is invested in staff safety and help mitigate a contributor to staff burnout (COVID-END and AHS Scientific Advisory Group, 2022). A face mask provides a visual reminder to staff, visitors, and patients that COVID-19 is still a risk. However, maintaining a continuous mask policy may also

contribute to mask fatigue and reduce overall adherence to policy or donning/doffing procedures.

- The consequences of COVID-19 infection, relative to other respiratory viruses (e.g. influenza or respiratory syncytial virus (RSV)) should be considered. There is relatively high acceptance of the risk of influenza infection compared to COVID-19 infection, and the consequences of nosocomial and occupational infections should be considered in the context of a highly-vaccinated population.
- As we transition to a potential state of "living with COVID-19", the prevalence and circulation of other respiratory viruses in the population and the accompanying health system effects must be considered together. There is evidence of a surge of influenza and RSV due to "immunity debt" that may present a higher risk of nosocomial transmission than COVID-19 (Hatter et al., 2021). This has implications on workforce planning (both clinical and non-clinical) as well as patient safety. Continuous masking may attenuate transmission and attendant consequences of other respiratory viruses, in addition to COVID-19.
- Other changes to "bundled" healthcare transmission protection measures are under consideration. Given the uncertainty in the pandemic trajectory, a stepwise and gradual approach guided by internal data and experience is suggested. Continuous masking offers potential additional potential benefit over measures such as symptom screening in individuals who may be pauci-symptomatic or who may shed viable virus after infection but following symptom resolution.

The vulnerability of the population in the healthcare setting is also relevant. If there is documented stability in community transmission without VOC concerns, stepwise change should consider maintaining continuous masking in settings with a high proportion of vulnerable individuals (eg. long-term care, cancer care, immunocompromised patient wards) who may benefit from masking, and lifted in lower-risk settings such as non-clinical facilities (i.e. corporate or administrative buildings).

There is limited evidence on metrics that might be used to determine the thresholds for lifting or implementing universal masking policies. Nova Scotia recommends community case positivity rates; Ontario recommends community positivity rate, wastewater surveillance, and disease severity; and the United States Centers for Disease Control and Prevention recommend a matrix of indicators including COVID-19 testing –weekly new positive/100,000 in previous and % positivity, wastewater and syndromic surveillance, high risk settings/events, to describe the level of community transmission (Centers for

Disease Control and Prevention, 2022b). Notably, these metrics rely on a robust testing strategy that accurately reflects community transmission. Vaccination rates were not identified by other jurisdictions as part of their indicator framework and should be considered in the context of current vaccine effectiveness. A need to develop a process of iterative risk review of a set of potential indicators was identified and this will be expanded in a companion SAG discussion document.

There was limited evidence identified from non-Canadian jurisdictions regarding thresholds for moving between levels of IPC interventions.

Committee Discussion

The committee generally supported the findings and commentary included in this review. They agreed with the writer and primary reviewers that a definitive recommendation about maintaining, modifying, or withdrawing a mask policy cannot be made by the Scientific Advisory Group given existing evidence. The discussion focused on the most effective way to clearly articulate the contextual factors that ought to be considered. These include but are not limited to: circulating COVID-19 variants and non-COVID respiratory viruses (eg. influenza & RSV); staff and patient vaccination rates; specific healthcare setting (eg. acute care vs. long-term care); environmental impacts of masking policies; communication and therapeutic implications of masking policies; and the acceptability and desire for masks among staff.

One committee member did not agree with the statement in the recommendations suggesting that continuous masking policies may be beneficial, as evidence for masking policies (whether targeted or continuous) is derived from the context of a bundle of activities and therefore the specific benefit of continuous masking policies cannot be determined. In the absence of controlled studies and thorough investigation, the reason for transmission events in one setting and not in another cannot be ascribed solely to the presence or absence of a continuous masking policy. The member was supportive of the holistic approach to modifying the policy, where the masking policy is considered in the context of a suite of interventions to reduce transmission risk.

A major limitation of the evidence - that masking policies are frequently not studied in isolation - provides a useful framework for considering this problem. Masking policies are often part of a larger IPC bundle that includes screening procedures, hand hygiene, additional PPE measures, vaccination policies, and visitor policies. Because we cannot quantify the specific benefit of masking within a suite of interventions, the committee was supportive of a step-wise approach to modifying what has now become the standard of care, along with monitoring of important indicators. For example, if the continuous masking policy is paused, a screening procedure might be maintained. A more rapid approach might be taken in lower risk settings (e.g. non-clinical areas), while high-risk settings with vulnerable populations could benefit from a slower, more methodical timeline.

Recommendations

1. The evidence overall is of low quality but suggests that continuous masking is potentially beneficial in reducing COVID-19 transmission risk in healthcare settings; however, the absolute benefit of a universal masking policy is dependent upon the absolute risk and consequences of infection. The modification of a mask policy (implementation or withdrawal) should be considered in the context of other factors such as the other IPC measures in place, and formally tracked epidemiologic risk indicators that will inform modification of masking and other healthcare respiratory virus control policies.
   Rationale: Although the evidence is overall low quality, on balance it suggests that masking in the health care setting (along with other IPC strategies) reduces the risk of nosocomial COVID-19 transmission. However, the contextual changes between the beginning of the pandemic and now are substantial. Masking should be considered as part of a bundle of IPC activities that are monitored in the context of circulating respiratory pathogens, staff presenteeism, hand hygiene rates, and vaccination rates and that are withdrawn in a stepwise manner.

Practical Considerations

In health care settings, the present policy (continuous masking) should be considered in the context of other measures in place as well as data-based indicators of respiratory infection transmission risk in the community and healthcare settings and reassessed regularly.

The additional absolute benefit of continuous masking would be expected to decrease as the prevalence of COVID-19 and other circulating respiratory pathogens decreases, and as the risk of severe outcomes decreases (due to vaccination), or if masking is found less efficacious against particular variants of COVID-19 or other respiratory illnesses.

Given the potential psychosocial/emotional, environmental, and resource implications of the continuous masking policy, if the policy is modified during scenarios assessed as lower risk, data collection to determine the effect on nosocomial respiratory infections, hospital outbreaks of COVID-19 and influenza, and staff morale **is recommended**.

The approach to de-implementation of masking policies may also possibly be locally customized to consider setting-specific contextual factors such as:

- Risk of other respiratory virus transmission that may be attenuated with masking
- Patient population vulnerability (immunocompromised, cancer care, long term care)
- Potential harms to patient care including impaired communication and therapeutic relationship

- Potential mitigating strategies available (e.g. masks with clear windows, campaigns to empower patients to ask their care provider to wear a mask, promotion of hand hygiene and aseptic technique)
- The overall bundle of respiratory illness prevention measures in use (e.g targeted masking, entrance screening, visitor policies, distancing, vaccination rates, etc.)

There are no validated, evidence-based thresholds or metrics to guide de-implementation of universal masking in the health care setting. The suggested metrics in the grey literature are predicated on factors such as community incidence data sources, wastewater indicators, and hospitalization rates. For a more fulsome discussion of indicator metrics for IPC interventions, please see the ancillary discussion paper developed by SAG, based on Alberta data.

- Potential community prevalence indicators suggested in the grey literature include (weekly):
  - Test positivity rates by RT-PCR for COVID, influenza, and other respiratory infections
  - Trend in COVID-19 RT-PCR positive rates
  - Calls to Healthlink for influenza-like illness
  - Wastewater surveillance from Centre for Health Informatics
  - COVID primary/attributable hospitalizations
- Healthcare-based metrics could include
  - Healthcare based outbreak data (number of outbreaks, volume of cases/outbreak)
  - Staff absenteeism for illness
  - WHS healthcare worker test positivity metrics

Research Gaps

In the reviewed literature there is no consistent definition of “universal masking” and could be applied on both a macro level (e.g. to a facility) or on a micro level (e.g. to a single unit).

The evidence for the effectiveness of masks is from acute care settings. There are contextual differences between acute care and continuing care that impact the breadth, effectiveness of masking policies and the consequences of removing these policies.

Masking was often implemented as part of a suite of interventions. The effect of masking is difficult to disentangle from the synergistic effects of the IPC intervention bundle (i.e. no controlled studies were identified studying universal masking polices). No studies were identified that addressed targeted masking strategies.

Information on PPE/masking compliance was not often reported in the identified studies.

No cost-effectiveness information for mask policies was identified.

No evidence was identified evaluating masks in the context of highly transmissible variants of concern.

There was no evidence on the additional effects of masks in a highly vaccinated population.

No evidence on the effects of a universal mask policy when COVID-19 is ubiquitous in the community.

Strength of Evidence

In general, the evidence identified and included from the primary literature was overall of very-low to low quality, although notably is very consistent – every included article reports that universal masking policies are an effective tool to limit COVID-19 spread within a hospital setting; this consistency increases confidence in this conclusion.

The observational methodologies in the body of evidence are insufficient to definitively determine the effect of universal masking. In most cases, there was no controlled comparator group to show the effect of masks. The hospitals where universal masking was implemented often concurrently introduced a suite of IPC measures that interact to protect individuals in the hospital (eg. enhanced cleaning measures; enhanced screening, testing, and isolation procedures; social distancing measures; gathering restrictions; and visitor restriction). In many cases, these additional interventions were not adjusted in the analysis and introduce a very high risk of confounding in these studies. In the case of outbreak investigations, the introduction of masks may be accompanied by increased staff awareness of circulating COVID-19, which may introduce prevention behaviours that are not accounted for in the analysis and further confound the results. Further, the epidemiological investigation reports often used HCW self-report methods and retrospective surveys to assess PPE use among the study population. These methods are at high risk of recall bias, social desirability bias, and ascertainment bias, which may result in an overestimate of the effectiveness of the intervention.

The included evidence was nearly entirely collected during 2020, when the efficacy of masks was still under debate and universal masking policies were considered a major policy response to the pandemic. Since masks have become generally acceptable and no hospital has published the results of lifting their universal masking policy, no new evidence has been published to confirm the effectiveness of mask policies in the face of high community transmission, COVID-19 variants of concern, and high vaccination rates among healthcare workers.

In addition, every jurisdiction experienced the start of the pandemic in a different way. Alberta, for example, had a very mild first wave that resulted in fewer than 10000 reported cases; by comparison, New York City and Northern Italy experienced high caseloads that overwhelmed healthcare resources, partially due to extensive transmission before the impacts of COVID-19 were recognized as significant. Differences in community transmission and public health measures may also impact the effectiveness of a hospital mask mandate.

Limitations of this review

This review is subject to several limitations. First, this is intended to be a rapid review and was conducted under tight time pressures, so the database search was thorough but pragmatic and only articles in English were included. It is possible that relevant studies were not identified.

As described above, the overall body of evidence is of very low - low quality even though is largely peer-reviewed. Accordingly, the recommendations arising from this review must be based on both evidence and expert opinion, to address the differences in context between the start of the pandemic and the present situation (e.g. highly transmissible variants of concern, high levels of community transmission, or masks in highly vaccinated populations).

Summary of Evidence

The database search for primary literature returned over 450 records related to masking policies as a COVID-19 control measure, published between 2020 and 2022. The librarian conducted an initial pre-screen for relevance and forwarded 135 articles for further review. Following a further title and abstract screen and a full text review step, 113 articles were excluded in accordance with the pre-determined inclusion and exclusion criteria. 22 primary articles were included in the narrative synthesis and are described more fully in Table 4 in the appendix.

The jurisdictional scan was conducted as a search of publicly available documents and supporting news stories from comparable jurisdictions to Alberta. Information was extracted regarding the presence or absence of a mask mandate for the general population; the presence or absence of a mask mandate for visitors to healthcare facilities; and the presence or absence of a mask mandate for staff working in the facility. Policies were identified for all Canadian jurisdictions. The results are described in Table 1.

What is the impact of continuous masking policies (compared with no continuous masking) on the number of facility outbreaks, and on in-hospital transmission to patients and staff?

Evidence from secondary and grey literature

One systematic review and meta-analysis was identified that reported on universal masking policies (Ingram et al., 2021); however, this systematic review examined multiple aspects of COVID-19 prevention measures and did not focus heavily on universal masking, with a very low-quality meta-analysis on the effects of universal masking. The analysis methods and data sources are not clearly described and the relationship between the original data and the conclusions is absent. Further, the included primary studies are subject to the same risk of bias and confounding that are described above.

Evidence from the primary literature

As noted above, 22 primary articles were identified for inclusion in this review. No randomized controlled trials were identified.

Five retrospective observational/descriptive studies were identified and included in this review (Abe et al., 2020; Ambrosch et al., 2020; Ariza-Heredia et al., 2020; Brandt et al., 2021; Pletz et al., preprint). In these studies, universal masking was largely implemented as a tool to limit SARS-CoV-2 transmission after the outbreak had been identified;; masking was frequently implemented in combination with other infection control strategies. These studies are of varying quality. Outbreak investigations offer limited support for universal masking but are not conclusive – the implementation of control measures and potential behaviour changes (e.g. PPE compliance) confound the results and there is no definitive way to demonstrate that the trajectory of the outbreak was changed by the masking policies without a comparator (i.e., the outbreak may have ended at the same time without the implementation of masking policies).

At the low end of the quality spectrum, the effectiveness of masking is speculative – the authors note that the outbreaks stopped after the implementation of enhanced COVID-19 prevention measures (including but not limited to universal masking) but offer minimal analysis or statistics to show that the masking policy was the single definitive reason for end of the outbreak (Abe et al., 2021; Ariza-Heredia et al., 2020; Brandt et al., 2021). The investigation conducted by Ariza-Heredia (2020) notes that of the three transmission clusters identified during their outbreak, all transmission events could be traced to time periods where the index and secondary cases were not wearing masks, such as socializing in the break room, eating, or talking on the phone while in the same office. Further, no HCW-to-patient spread was identified during this outbreak as surgical masks were worn during all patient encounters (Ariza-Heredia et al., 2020).

Two studies were identified where forward transmission was quantified after the implementation of masks but cannot be formally designated as pre-/post-implementation studies (Ambrosch et al., 2020; Pletz et al., preprint). Both showed substantial decreases in COVID-19 cases after the implementation of IPC bundles that included universal masking. Pletz (preprint) showed the HCW infection rate decreased from 10.1% in the pre-implementation period to 0.4% post-implementation of the IPC bundle. Similarly, Ambrosch (2020) showed that the rate of nosocomial COVID-19 infections decreased by nearly 80% (0.28 (5/27 COVID-19) to 0.06 (5/87) (p = 0.026)) following the implementation of a broad infection control bundle. Like the outbreak investigations, these two studies are confounded by the complementary IPC interventions and the potential for altered behaviour patterns in healthcare workers following implementation.

Five quasi-experimental studies showed that implementation of universal masking in healthcare settings significantly decreased the risk of COVID-19 among HCWs, although the results are heavily confounded (Gras-Valenti et al., 2021; Temkin et al., 2021; Tubiana et al., 2021; Walker et al., 2021; Wang et al., 2020). Gras-Valenti (2021) showed specifically that the incidence of COVID-19 cases among healthcare workers decreased from 22.3/1000 to 8.2/1000 following the implementation of universal masking (5 days after the State of Alarm was declared in Spain). This corresponds to a 63% decrease in relative risk of COVID-19 infection following the mask mandate, regardless of transmission from symptomatic or asymptomatic individuals (Gras-Valenti et al., 2021). Temkin (2021) also showed an inversion of the slope of COVID-19 incidence following the implementation of a universal mask policy as part of as set of interventions (leading to possible confounding). In the pre-intervention period, the adjusted slope in COVID-19 incidence among HCWs infected at work was 0.5 (0.2–0.8) (p= 0.001), compared to the post-intervention period where the slope changed to −0.2 (−0.3 to −0.1) (p<.001) (Temkin et al., 2021). This change in slope in the post-intervention period is also shown by Wang (2020), who reports mean increase of case positivity rates (1.16% per day) among HCWs in the pre-intervention period and a mean decrease of positivity rates of 0.49% in the post-intervention period (net change of 1.65% (95% CI, 1.13%-2.15%; P < .001)).

Tubiana (2021) and Walker (2021) both show that reported exposures to COVID-19 also declined in the period following universal masking implementation. Tubiana (2021) reports that among 146 exposed HCWs, exposure from a COVID-19 positive patient declined from 67% to 16% in the periods before and after the masking policy, respectively. This suggests that colleague-to-colleague transmission became predominant and supports the need for masking in non-patient care spaces (Tubiana, 2021). Walker (2021) reports a similar finding, where healthcare worker reports of COVID-19 due to patient exposure significantly decreased in the post-intervention period. Instituting universal masking decreased the reported rate per patient-day of

exposure without any mask by 73%, (RR 0.27, 95% CI 0.14-0.55), showing the protective effect of surgical masks in non-COVID-19 care spaces. This was not accompanied by a change in the risk from aerosolizing procedures (Walker et al., 2021).

Transmission to patients was also reduced in settings where universal masking was included as part of an infection control bundle (Chang, Hur & Park, 2020; Habermann et al., 2021; Williams et al., 2021).). Habermann (2021) found no cases of nosocomial SARS-CoV-2 transmission among 1310 patients who tested negative at admission and completed serological testing following their hospital stay while a complete IPC bundle was in place. Similarly, in HCWs who were identified to be working during their period of communicability, only 3 patients tested positive for COVID-19 among 133 who completed follow up (214 eligible) (Williams et al., 2021). These findings suggest that masks are an effective tool for limiting patient risk of infection due to HCWs.

Three studies were identified that showed the risk of COVID-19 infection in settings with low PPE compliance or no universal mask policy was increased for HCWs in perceived lower risk settings (such as non-COVID-19 units, administrative settings, or break rooms) than in higher risk settings (such as dedicated COVID-19 units) in hospitals (Çelebi et al., 2020; Contejean et al., preprint; Gohil et al., 2021). Two case-control studies (Çelebi et al., 2020; Contejean et al., preprint) showed that close contacts to colleagues without protection (such as during lunch) significantly increased the odds of SARS-CoV-2 infection. The higher-quality study, Contejean (preprint), reports a 2.6X (OR 2.58 [1.49-4.60]) increase in infection odds in those who did not use masks, compared to those who did, when in close contact with colleagues. In addition, the cross-sectional study by Gohil (2021) found that forward transmission in three outbreaks occurred in non-patient care settings, such as in the breakroom, at the nursing station, and in skills classes where masks were less frequently worn (compared with other areas where masks were used). Gohil (2020) also showed that working in a dedicated COVID-19 unit, where a higher level of PPE was required at all times, was protective against infection – odds of COVID-19 for workers on these units was 50% lower than for workers on non-COVID-19 units (OR 0.53, CI = 0.30–0.94, p = 0.03).

Two studies showed that infection risk to healthcare workers was increased largely due to home or community prevalence, rather than from hospital work in settings with high PPE compliance or a universal mask mandate (Bahrs et al., preprint; Belan et al., preprint). A case-control study by Belan (preprint) showed that the odds of a HCW contracting COVID-19 in the community (where universal masking is not enforced) were 9-fold higher than the odds of an occupational exposure ((aOR 19.9 [12.4-31.9]). However, Belan (preprint) also showed that eye protection and gowns were protective, which suggests confounding due to other factors such as behaviour or vaccination. Similarly, Bahrs (preprint) found that SARS-CoV-2 seropositivity was significantly associated with a COVID-19 contact at home, rather than at work (OR 39.06, 95% CI

5.17 to 295.00), noting that self-reported PPE compliance among HCWs was 98% in high-risk areas and 70% in intermediate risk areas.

Community risk and occupational risk are difficult to distinguish in healthcare workers and are likely confounded by behaviours in this population. Three studies were identified that showed the difference in COVID-19 incidence in hospitals with a universal mask policy compared with the COVID-19 incidence in the community / general population (Contejean et al., 2021; Kociolek et al., 2021; Lan et al., 2020;; Chou et al., 2020).; Chou et al., 2022). Contejean (2021) is the weakest of the three studies, but showsshows that when community COVID-19 incidence is increasing, an increase in HCW mask compliance is accompanied by decreasing COVIDCOVID-19 case rates among HCWs. This also shown by Kociolek (2021) in their quasi-experimental study. In the pre-intervention period, the test positivity rates for HCWs and the community were 18.4% and 10.7%, respectively; while in the post-intervention period, the positivity rates decreased to 9.0% for HCWs and increased to 12.8% in the community (Kociolek et al., 2021). Lan (2020) quantifies a similar phenomenon. In the pre-intervention phase, the occupational incidence and community incidence of COVID-19 had overlapping slopes (0.96 (0.80 to 1.13) and 0.99 (0.92 to 1.07), respectively); in the post-intervention phase, the community incidence slope continued to rise (0.99 (0.94 to 1.05)) while occupational incidence slope decreased (−0.68 (−1.06 to −0.31)). When the epidemic began to decline, the slopes once again overlapped (although in the negative direction) (Lan et al., 2020). This suggests universal masking policies are effective for limiting hospital-based transmission of SARS-CoV-2; this study also may suggest that overall prevalence and absolute risk of transmission may influence the absolute effectiveness of masking.

Synthesis of the Information Relating to Question 1

While there are no randomized controlled trials, and the quality of the available evidence is variable, there is consistency in the results of included studies. This body of evidence suggests that infection control measures are associated with protection of both HCWs and patients from occupational exposure to SARS-CoV-2. As noted above in the ‘Strength of Evidence’ section, the specific impact of universal masking policies is difficult to isolate due to common implementation of a bundle of infection control strategies and behaviours; risk of recall bias and social desirability bias are also likely. The evidence was nearly entirely collected in the early stages of the pandemic, before the availability and uptake of vaccines and emergence of subsequent variants. While uncertainty exists, evidence supports that medical masking in health care settings reduces risk of transmission on the COVID-19 respiratory virus.

The relative benefit of any intervention to reduce transmission of COVID-19 will be modified by the absolute risk of transmission and severity of subsequent infection. While low quality, findings from Lan et al suggested that the impact of masking was

observable in an epidemic phase but became undetectable as the epidemic waned. The benefit of a universal mask policy therefore should be contextualized in the setting of absolute risk (and benefit), consideration of possible negative consequences of masking, and other considerations as the acute phase of the pandemic wanes.

Negative implications of masking include cost (in the setting of a publicly funded health care system where efficient use of resources is important), and potential environmental impacts and impact of communication in healthcare (especially in hard-of-hearing populations); previous SAG reviews have also reported on the potential harms arising from mask use and work conducted in partnership with the COVID-END consortium has shown that provision of sufficient PPE and organizational policies to keep HCWs safe is an important part of mitigating staff burnout. Additionally, the optics of a universal mask policy are also important – a face mask can remind staff, visitors, and patients that COVID-19 (among other respiratory viruses) is still a risk that needs to be considered, and that other activities (such as hand hygiene, physical distancing, and self-monitoring for symptoms) should continue.

From a workforce management perspective, universal masking policies may reduce the risk of other respiratory virus transmission in healthcare settings. The rates of influenza A, influenza B, and respiratory syncytia virus were all zero between February – April 2020 due to COVID-19 infection control practices (Wong et al., 2020). As respiratory illnesses return to circulation, a universal masking policy may limit the number of HCWs who might require sick time due to illness, regardless of the respiratory virus. In the absence of a symptom screening program for either visitors or staff, a universal mask policy can form part of a multi-modal strategy for protecting vulnerable populations in healthcare settings. There is evidence to suggest that the public health measures of the past two years have resulted in “immunity debt” that is a suspected cause of surging RSV cases (Hatter et al., 2021).

There is also an argument to made for policy change that allows a more local, tailored approach that can integrate transmissibility risk (community or HCW prevalence) as well as the consequences of transmission in specific patient populations – facilities or settings with a high proportion of vulnerable individuals (eg. long-term care or cancer care) at risk of severe consequences with infection may derive more benefit from universal masking policies compared to other settings (e.g. outpatient clinics that do not care for immunocompromised patients).

What decisions around continuous masking in healthcare facilities (both acute care and long-term care?) are being made elsewhere?

Evidence from secondary and grey literature

The World Health Organization states that using a face mask is an effective and low cost strategy to reducing the spread of COVID-19 (World Health Organization, 2022).

Mask mandates were implemented across Canada in all public settings and have gradually been lifted nationwide through the spring of 2022. While masking mandates are no longer in effect for the general public, there remains required and recommended masking policy in healthcare settings across Canada.

All Canadian provinces, except Ontario, currently require staff, visitors, and designated support persons to wear masks in most healthcare settings. Exceptions occur in non-clinical settings (such as administrative departments)) where physical distancing is in place, usually during periods of 'low risk' for COVID-19 transmission.

Current Ontario policy offers recommendations (rather than requirements) that allows each health care organization to establish their own masking policies (Public Health Ontario, 2022). Ontario's mandatory masking policy (including in hospitals) expired on June 11, 2022, however, long term care and retirement settings will continue to enforce mask use, and most health care institutions have implemented their own masking requirements (McKenzie-Sutter, 2022). Similarly, in Alberta, the provincial mask mandate expired on June 14, 2022, and mask requirements in healthcare settings shifted to an organizational policy by Alberta Health Services. There are only limited examples of private health care providers lifting mask mandates and indicating mask use is optional. "As a community healthcare facility, masks are encouraged and available to all, including when you first enter the clinic and during your appointment" (Lifemark Health Group, 2022). This jurisdictional scan did not identify any Ontario hospitals that have changed masking requirements since the expiration of the provincial mask mandate.. Table 1 provides a summary of each province's masking mandate, exceptions for health care settings and any health care worker specific policy (if available).

Of note, the varying structures of the Canadian healthcare jurisdictions impact the ultimate penetration of the provincial policy. For example, the provincial, highly integrated structure of AHS means that the masking policies will not differ across the province; conversely, in Ontario, the large number of healthcare organizations and fragmented private/public nature of long-term care facilities implies that the healthcare masking guidance could vary widely across the province and across facilities.

Table 1. The Canadian Provincial Masking Mandates, Exceptions and Health Care Worker Policy (June 2022)

Province	Public Masking Mandate	Health Care Facilities	Health Care Worker Specific Policy
Alberta	NO. Mandatory mask requirements were lifted on March 1, 2022 and removed for public transit on June 14, 2022. Masking in Alberta Health Services and contracted health facilities has shifted to organizational policy. Masking is still required in congregate care settings until June 30, 2022 (Government of Alberta, 2022).	Organizational policy. When entering an AHS facility, patients, designated family/support persons, and visitors shall be informed of the requirement for continuous masking and provided with a medical mask. Designated family/support persons and visitors in AHS facilities must wear a medical mask or their own KN95 or N95 respirator at all times. Adult inpatients do not require continuous masking in their bed space. Adult inpatients, when leaving their bed space or moving within other areas of the AHS facility, shall continuously mask. Adult patients in congregate care settings are not required to mask within these settings unless otherwise required. Children are expected to wear masks in AHS facilities (Alberta Health Services, 2022).	AHS requires continuous masking by health care providers who work in AHS facilities or AHS settings when working in patient care areas; providing direct patient care; in all areas of an AHS facility or AHS setting (both clinical and nonclinical). This includes any area within an AHS facility or AHS setting where there may be contact with patients, designated family/support persons, visitors, or the public or performing job duties while engaging with the public. Staff that work in areas with no direct contact with patients or patient items are required to wear a mask continuously in all areas of their workplace unless they are at a work space separated by at least two metres, separated by a physical barrier, or working alone in an individual office. (Alberta Health Services, 2022).
British Columbia	NO. Mandate was lifted March 11, 2022 (including public transit) (Government of British Columbia, 2022) health care exception	Government Policy Masks are required in health care settings(Government of British Columbia, 2022).	Health care workers (clinical and non-clinical staff): all persons working in a clinical unit/setting or patient care area, in long term care, private hospitals, stand alone extended care hospitals designated under the Hospital Act, seniors' assisted living settings and provincial mental health facilities must wear a medical mask at all times, including in common areas and break rooms unless eating and/or drinking (British Columbia Ministry of Health, 2021).

Province	Public Masking Mandate	Health Care Facilities	Health Care Worker Specific Policy
Manitoba	NO. As of March 15, 2022 masks are no longer required (Province of Manitoba, 2022).	Government Policy Health-care facilities continue to require a mask be worn by anyone present in the facility, including outpatients, visitors, and health-care workers. This requirement – which applies to hospitals, health centres, long-term care facilities and other care settings (Shared Health Manitoba, 2022).	Health-care facilities continue to require a mask be worn by anyone present in the facility, including outpatients, visitors, and health-care workers. This requirement – which applies to hospitals, health centres, long-term care facilities and other care settings(Shared Health Manitoba, 2022).
New Brunswick	NO. Masks are no longer mandatory in indoor public spaces as of March 14, 2022. However, they may still be required in some vulnerable settings such as hospitals and long-term care facilities (New Brunswick Canada, 2021). health care exception	Government policy Patients and designated support people entering facilities operated by the regional health authorities will continue to wear a medical, KN-95 or N-95 mask. In long term care settings visitors are required to wear a mask, however, they may remove their mask when in a resident's room at the resident's discretion (New Brunswick Canada, 2022).	Not found
Newfoundland	NO. As of March 14, 2022 (May 24, 2022 for schools) wearing a face mask is strongly recommended in public indoor settings, but is not required (except health care settings and some workplaces) (Newfoundland & Labrador Canada, 2022).	Mandatory masking remains in place at hospitals, long-term care facilities and health-care facilities throughout the region(Eastern Health, 2022).	Not found
Northwest Territories	NO. As of April 1, all restrictions put in place during the pandemic will become recommendations and residents can choose whether to	Medical grade masks are required in all NWT Health and Social Services facilities and offices (they will be provided) (Northwest Territories Health and Social Services Authority, 2022).	Not found

Province	Public Masking Mandate	Health Care Facilities	Health Care Worker Specific Policy
	continue following them (Canadian Press Staff, 2022)		
Nova Scotia	NO. Masks mandate was lifted March 21, 2022,, and lifted May 24, 2022 in schools , but the health order was maintained health-care facilities and in long-term care and other congregate centres (Keith Doucette, 2022).	Uses a four-tier risk assessment. In all four tiers medical masks are required by visitors for entry, screening, in waiting rooms, in patient groups, when outside of the patient bed space or in the presence of a HCW, in ambulatory settings (COVID Network Nova Scotia Health, 2022). See Table 2 for further details.	Uses a four tier risk assessment. In Tier one (lowest risk), masking is required in health care settings for HCW with the following exceptions: non-clinical meeting rooms, administrative meetings, conferences (including off-site), cafeteria, break rooms. However no regions in the province currently score better than Tier 3 (high risk) (COVID Network Nova Scotia Health, 2022). See Table 2 for further details.
Nunavut	NO. Mask mandate lifted April 11, 2022 (Venn, 2022)	Masks continue to be mandatory in all government offices, health facilities (including Elder facilities) and schools (Government of Nunavut, 2022).	Not found
Ontario	NO. As of June 11, 2022, except in long-term care and retirement homes (where mandate continues) (Cook, 2022).	Determined by COVID-19 risk, ranked as low risk, transition period, and high risk. During all risk levels, visitor and caregiver masking in 'recommended'. For patients during high risk and transition periods masking is 'recommended when ambulatory, to be considered when receiving care' and 'consider' when low risk rating (Public Health Ontario, 2022).*	Determined by COVID-19 risk, ranked as low risk, transition period, and high risk. During all risk levels, HCW masking in clinical areas is 'recommended' and in non-clinical areas is 'recommended' for all but low risk periods (where it is rated 'consider') (Public Health Ontario, 2022).*
Prince Edward Island	NO. As of June 3, 2022 masks are only required in high risk settings (lifted in public spaces May 6, 2022; schools May 24, 2022; and transit June 3, 2022)(Government of Prince Edward Island, 2022).	Masks are required in certain high risk settings: hospitals, long-term care, community care(Government of Prince Edward Island, 2022).	Not found

Province	Public Masking Mandate	Health Care Facilities	Health Care Worker Specific Policy
Saskatchewan	NO. Mandate lifted February 28, 2022 (Kliem, 2022).	All families and visitors are still required to wear a medical grade mask. Masks are required at all times in acute care facilities and in common areas in Long term care facilities. In Long term care, masks are no longer required in the residents' rooms, unless the resident is COVID positive and on precautions (Saskatchewan Health Authority, 2022a).	Continuous masking is required for all staff and physicians on entry to and in all areas of an SHA building/facility at all times, unless eating and/or drinking. Exception: staff who work in a private office alone (with walls and a door) do not require a mask while they are in their office (Saskatchewan Health Authority, 2022b).
Quebec	NO. As of May 14, 2022 mandate removed except health care settings and public transit (Strikeman Elliott, 2022).	There is no firm date for eliminating the obligation to wear a mask in public transport and health care settings (Strikeman Elliott, 2022).	It is mandatory to wear a protective medical-grade mask in some workplaces, particularly for healthcare workers (Government of Quebec, 2022).
Yukon	NO. As of March 18, 2022 (except in school settings was lifted May 24, 2022) (Government of Yukon, 2022).	A mask is required in: long-term care homes; health facilities; shelters; group homes; the correctional centre; and hospitals (Government of Yukon, 2022).	All staff in clinical areas wear a surgical/procedural mask and eye protection at all times; administrative staff and those without direct patient contact may wear a surgical mask; and recommend all patients wear a surgical mask (Yukon Department of Health and Social Services, 2022).

*NOTE: while language in Ontario has shifted from required to recommended mask use, Ontario-based health care organizations have created independent policy.

There is limited evidence in the jurisdictional scan that provides specific information regarding the criteria or rationale for changing mask mandate in healthcare settings. Table 2 provides a summary of the guidance provided by Nova Scotia specific to masking protocols in healthcare settings, based upon assessed COVID-19 risk (informed by community risk level, staff absences, admissions, hospitalizations and health care risk-HCW vaccine uptake). In Ontario, masking policies are suggested based upon three periods of risk (high risk period, transition risk period and low risk period) based upon outbreaks in healthcare settings, hospital and ICU admissions, and community transmission(Public Health Ontario, 2022). However, Ontario does not provide any circumstance warranting 'required' masking, with recommended being the highest suggestion. For example, in clinical areas at all levels of risk HCWs are 'recommended' to mask.

Table 2. Nova Scotia Mask Protocols Based Upon COVID-19 Risk Tier

	Tier 1 Low Risk: Almost Normal Pre-COVID	**Tier 2 Moderate Risk**	**Tier 3 High Risk**	**Tier 4 Extreme Risk**
Community risk level (% positivity), 14-day moving average	**<10%**	**10-19%**	**20-29%**	**≥30%**
Inpatient settings Essential care partners, inpatients where possible	Medical or cloth mask required when outside of the patient bed space or in the presence of a HCW	Medical mask required when outside of the patient bed space or in the presence of a HCW	Medical mask required when outside of the patient bed space or in the presence of a HCW	Medical mask required when outside of the patient bed space or in the presence of a HCW
Ambulatory settings: Patients, essential care partners	Required (medical or cloth)	Required (medical)	Required (medical)	Required (medical)
Masks for HCWs	Required (medical)	Required (medical)	Required (medical)	Required (medical)
Waiting Room	May use up to 100% of capacity with medical mask required. Those who are unable to mask should be distanced from others.	May use up to 100% of capacity with medical mask required. Those who are unable to mask should be distanced from others.	May use up to 50% of capacity with medical mask required. Direct patients to exam room as quickly as possible.	May use up to 25% of capacity with medical mask required. Direct patients to exam room as quickly as possible.

Masking policies in selected jurisdictions in the United States

The following table outlines States in the United States of America that **require** the use of masking in certain settings. Unspecified States have no requirements, although may have 'recommendations'.

Table 5. Continuous Masking Requirements by State

In-person meetings, small work team check-ins, educational sessions in non-clinical areas	Masking recommended.	Masking required. Masks immediately back on after eating/drinking.	Masking required. Masks immediately back on after eating/drinking.	Masking required at all times. No food or drink permitted.
Team meetings: unit daily huddles, small work-team check-ins, critical training, in clinical areas	Masking required.	Masking required.	Masking required.	Masking required.
Administrative meetings where patient care is not delivered (boardrooms, conference spaces)	Masking recommended.	Masks back on immediately after eating or drinking.	Masks back on immediately after eating or drinking.	Masking required at all times.
Patient groups	Masking required.	Masking required.	Making required.	Masking required at all times.
Large meetings of >100	Masking recommended.	N/A virtual meetings only..	N/A virtual meetings only.	N/A virtual meetings only.
Cafeteria seating	Masking recommended. when not eating/drinking.	Masks immediately back on after eating/drinking.	Masks immediately back on after eating/drinking.	Masks immediately back on after eating/drinking.
Break rooms	Masking optional.	Masks immediately back on after eating/drinking.	Masks immediately back on after eating/drinking	Masks immediately back on after eating/drinking.

Summarized from From: COVID Network Nova Scotia Health (2022)

Ontario also uses a risk tier system to define masking protocols, but the specific metrics and thresholds are not described. They advise using stricter policies when community incidence is high, using proxy metrics such as community positivity rate, wastewater surveillance, and disease severity (e.g. hospitalizations, ICU admissions) to assess community incidence (Public Health Ontario, 2022)

Other Jurisdictions

The European Centre for Disease Prevention and Control advocate (as of February 7, 2022) that face masks should be used to reduce community transmission of COVID-19, particularly in confined spaces such as on public transportation, where physical distancing is not possible, in care settings, and for vulnerable people (and those interacting with them) (ECDC, 2022). According to the ECDC, most European countries have lifted general masking requirements with some exceptions (such as Germany, Italy

and Portugal). Countries with persisting mask mandates are generally limited to confined spaces (such as transit) and healthcare settings. Similar to Canada, mask mandates have been lifted in England (as of April 1, 2022), with exceptions including hospitals and primary or community care settings, and those accessing or visiting care homes(Department of Health and Social Care, 2021). In Wales and Northern Ireland, use of a face mask in health care settings is strongly recommended (not required) (NI Direct Government Services, 2022; Welsh Government, 2022).

Currently in the United States, 14 States have required masking in specific settings, with 13 specifying health care settings as a required site for mask use (Mendelson, 2022). In States where mask use is 'recommended' some healthcare organizations have lifted masking requirements, particularly in non-clinical settings (Gamble, 2022). Despite this, the CDC advocates that all healthcare workers should use a mask (N95, respirator or well-fitting surgical facemask) in a healthcare setting (Centers for Disease Control and Prevention, 2022). In May 2022, the CDC further clarified that despite changes in masking guidance, "staff, patients, residents and visitors should continue to wear masks as recommended in all healthcare facilities" (American Hospital Association, 2022). Table 5 in the appendix provides a summary of the United States that continue to require masking in healthcare and other settings.

Synthesis of the Information Relating to Question 2

The jurisdictional scan suggests that overall, health system decision-makers have continued universal mask policies that have been in place since 2020 and some jurisdictions are developing data-based risk assessment guidance documents.

However, the metrics that might be used to inform a policy shift away from continuous masking were not clearly defined in the jurisdictional scan. Nova Scotia is the most transparent with their guidance and gives concrete levels of risk for relaxing mask use based on community test positivity rate (although the evidence upon which this was based was not identified in the publicly available documents).

The United States CDC uses the following indicators to determine the community level of COVID-19 (Table 3) (Centers for Disease Control and Prevention, 2022b). These indicators and thresholds can be used to inform the stringency of public health recommendations to the population. At low levels, the emphasis rests on vaccination, ventilation, testing, and isolation; at medium levels, additional prevention steps are taken to protect vulnerable populations; at high levels, even more active measures are implemented (such as universal masking) to protect all individuals and communities (Centers for Disease Control and Prevention, 2022b). This framework can also inform the behaviours recommended to individuals and the supporting public health strategies (Centers for Disease Control and Prevention, 2022b).

Table 3. Indicators and thresholds used to determine community levels of COVID-19. The higher of new COVID-19 admissions and percent of occupied beds is combined with the daily new COVID-19 cases to generate an estimate of circulating COVID-19 in the community.

New COVID-19 cases **Per 100k people in the past 7 days**	**Indicators**	**Low**	**Medium**	**High**
Fewer than 200	New COVID-19 admissions per 100k population (7-day total)	< 10.0	10.0-19.9	≥ 20.0
	Percent of staffed inpatient beds occupied by COVID-19 patients (7-day average)	< 10%	10.0-14.9%	≥15%
200 or more	New COVID-19 admissions per 100k population (7-day total)		< 10.0	≥ 10.0
	Percent of staffed inpatient beds occupied by COVID-19 patients (7-day average)		< 10%	≥ 10%

Table adapted from Centers for Disease Control and Prevention (2022b)

Evolving Evidence

The evidence on this topic is slowly evolving. Although research focused heavily on the effectiveness of different types of masks and mask policies at the beginning of the pandemic, IPC interests shifted to other topics after masks were widely adopted. There is no direct evidence on mask policies that relates to highly transmissible variants of concern, high levels of community transmission, or masks in highly vaccinated populations.

Appendix

List of Abbreviations

AHS: Alberta Health Services

AI: Accumulated Incidence

AR: Attributable Risk

CDC: United States Center for Disease Control and Prevention

COVID-19: Coronavirus Disease 2019

ECDC: European Center for Disease Control

HCW: Healthcare Worker

IPC: Infection Prevention and Control

OR: Odds Ratio

PPE: Personal Protective Equipment

RR: Risk Ratio

RT-PCR: Reverse Transcriptase Polymerase Chain Reaction

SAG: Scientific Advisory Group

VOC: Variant of Concern

Evidence Extraction Table

Table 4. Evidence extraction table for included primary literature retrieved in the database search.

Reference	Study Type	Population / Setting	Intervention / Exposure	Comparator	Results	Notes
Abe et al., 2021 Japan	Retrospective descriptive study (outbreak investigation)	Long-term care	- Hand hygiene and the wearing of masks and cloth aprons were routinely practiced by all HCP before the COVID-19 outbreak - Index case became symptomatic following a night shift and subsequently tested positive for SARS-CoV-2 by RT-PCR three days later - Enhanced PPE & COVID-19 surveillance was implemented in the facility after confirmation of COVID-19 (4 days post-symptom onset in index case)		- Index case followed standard precautions - HCWs not considered as being in “close contact” with the index case because they used surgical masks and adhered to standard precautions. - 17 confirmed cases of COVID-19:14/93 (15.1%) residents, 3/69 (4.3%) HCWs, and 0/22 (0.0%) visitors - the secondary spread ratio from the index case to facility residents was approximately 15% - Effect of surgical masks to prevent COVID-19 spread is unclear	- Low quality study - High risk of recall bias and social desirability bias - Adherence to pre-COVID IPC protocols (by both residents and staff) is unclear - Data from March 2020
Ambrosch et al., 2020 Germany	Retrospective observational study	Patients admitted to acute care between March 1 - June 10, 2020 (n= 123 lab-confirmed COVID-19 cases)	Implementation (March 26) of strict hygiene (IPC) bundle that included continuous masking (surgical mask). All inpatients were assessed daily for symptoms of COVID-19. Patients wore surgical masks outside of their room or when others were in the room. All staff caring for COVID-19 patients used FFP2 respirators, goggles, gowns & gloves	Nosocomial COVID-19 infections prior to continuous masking obligation	- During the observational period, 10 nosocomial cases were identified, 5 cases in March (before intervention), and 5 cases in April - SARS-CoV-2 infected employees (n = 18): 5 were found within March, and 13 by the end of April. - after introducing masking, the rate of nosocomial SARS-CoV-2 infections decreased by almost 80% from 0.28 (5/27 COVID-19) to 0.06 (5/87) (p = 0.026) - the nosocomial incidence density of SARS-CoV-2 as a parameter for the nosocomial risk of spread decreased from 0.0007 to 0.00018 by more three fourthsfourths (p = 0.031, rate ratio 0.25 (after/before) (95% CI 0.06, 1.07)) (# nosocomial infections / 1000 patient days) - IPC bundle (including masking) associated with reduction in nosocomial SARS-CoV-2 infection	- Low-Moderate quality - Small sample size

Reference	Study Type	Population / Setting	Intervention / Exposure	Comparator	Results	Notes
Ariza-Heredia et al., 2020 United States (Texas)	Retrospective descriptive analysis (outbreak investigation)	Cancer center	IPC bundle implemented the day after staff gathering that became the first COVID-19 infection cluster among staff members. IPC measures continued throughout two additional COVID-19 clusters among staff. Included: - Enhanced communications - Enhanced cleaning - Continuous masking - Social distancing and gathering prohibited - Testing for asymptomatic employees - 10-day isolation for symptomatic employees		- Cluster 1: 8 employees (of 32) tested positive for SARS-CoV-2 over the 20-day test-trace period**. After implementation of continuous masking, there were no positive cases of COVID-19 among patients who visited this area during their care at our institution and up to 14 days from the last diagnosed employee.** - **Cluster 2: Four employees on different units tested positive. All wore masks while in contact with patients, no nosocomial transmission detected.** - Cluster 3: 2 people with a shared office tested positive. Masks were removed while talking on the phone (No patient contact)	- Very low quality study - Many interventions implemented at once; cannot be disentangled
Bahrs et al., preprint Germany	Prospective cohort study	Employees at acute care facility (n=660)	- Employees working in high-risk patient care areas (ie. COVID-19 units) - Employees working in intermediate risk areas (ie. minimal work with COVID-19 patients) - Low-risk employees (eg. administrative staff with no patient contact) Mandatory masking across the hospital		- 18 employees (2.7%, 95% CI 1.6%-4.3%), 12 HCWs (2.5% within the group HCWs, 95% CI 1.3%-4.3%) and 6 administration employees (3.3% within the group administration employees, 95% CI 1.2%-7.1%) had detectable SARS-CoV-2 IgG antibodies in at least one immunoassay - No evidence for an association of antibody positivity with the demographics, the professions or COVID-19 risk area (all p-values from logistic regression >0.05) - **The only parameters that were associated with SARS-CoV-2 seropositivity in employees included close COVID-19 contact at home (OR 39.06, 95% CI 5.17 to 295.00)** - **Compliance of HCWs working in COVID-19 high-risk was 98.3% and in intermediate-risk areas 69.8%**	- Low-moderate quality - Risk of recall bias and social desirability bias - No evaluation of mask compliance - Posted to MedRxiv in 2020 (pre-vaccine, pre-variant)

Reference	Study Type	Population / Setting	Intervention / Exposure	Comparator	Results	Notes
					- The results of the study support the importance of adequate PPE use to prevent transmission from patient to HCW	
Belan et al., preprint France	Matched case-control study	General population survey of community and occupational SARS-CoV-2 exposure 1:1 matching (n= 4152) April-July 2021	Cases: Individuals who selected "healthcare worker or working within health field" on questionnaire	Controls: General population, selected from French IPSOS database or health-related professional organizations	- In the subgroup of HCWs in contact with COVID-19 patients during the preceding 10 days (n = 2086), 1616 (77%) declared systematically wearing a gown, 1608 (77%) gloves, 1490 (71%) a N95 respirator, 1345 (64%) goggles/faceshield and 1146 (55%) an apron for patient care. - **In multivariable analysis, the strongest predictor of contracting COVID-19 was exposure to an infected person outside work (aOR 19.9 [12.4-31.9])** - **Occupational exposure to an infected colleague (aOR 2.26 [1.53-3.33]), to COVID-19 patients (aOR 2.37 [1.66-3.40]), or working in a unit harboring a cluster of nosocomial cases (aOR 2.14 [1.50-3.06]) increased the risk of HCW infection** - N95-respirator-conferred protection was comparable to that of surgical facemask in all settings after adjustment - COVID-19 patient-facing activities increased the risk of getting infected, **while colleague-related and mostly community exposures appear to represent much higher risk of infection compared to occupational exposure.**	- Moderate quality study - Risk of recall bias and social desirability bias - Largely pre-vaccine - Pre-omicron
			Questionnaire collected sociodemographic information, occupational activities, contact patterns, PPE use, immunization, COVID-19 history. Since the start of the pandemic, French guidelines have recommended universal masking with surgical facemasks for general patient care, and N95-respirator use for aerosol-generating procedures			
Brandt et al., 2021 Germany	Descriptive analysis (outbreak investigation)	Health care professionals in acute care	- Three categories of COVID-19 exposure identified: 1. High risk (close contact, no PPE) 2. Low risk (minimal close contact, no PPE) 3. Lowest risk (no close contact, PPE)		- All COVID-19 cases reported having social contact (lunch, conversations, small gatherings, etc). without masks, despite the masking policy in place. - co-workers were not considered as a possible viral source and the masks were removed without concern	- Low quality study - high risk of recall bias and social desirability bias - risk of confounding

Reference	Study Type	Population / Setting	Intervention / Exposure	Comparator	Results	Notes
			- PPE included FFP2 respirator on COVID-19 units, surgical mask for non-COVID-19 patient encounters - 13 individuals were identified within the infection cluster		- After rigorous implementation of hygiene measures, continuous efforts of meticulous tracing of contacts and appropriate quarantine measures, resulted in no additional in-house infection 6 weeks after the first case. - we hypothesize that the successful containment of the infection was mainly due to consequent donning of face masks.	- no rigorous investigation into the use or role of masks - pre-vaccine, pre-variant
Çelebi et al., 2020 Turkey	Case-control study	Healthcare workers in a tertiary acute care hospital between March 20-May 20, 2020 (n= 181)	Cases: The HCWs who tested positive for SARS-CoV-2 by RT-PCR (n=37)	Controls: The HCWs who tested negative for SARS-CoV-2, had no symptoms compatible with COVID-19 infection and had stayed asymptomatic for 14 days following the RT-PCR test (n= 134)	Significantly higher in cases than controls: - inappropriate use of PPE during the care of suspected or confirmed cases of COVID-19 (P = .003) **- staying in the same personnel break room as an HCW without a medical mask for more than 15 minutes (P = .000)** **- consuming food within 1 m of other HCWs (P = .003)** Logistic regression for risk of transmission: **- inappropriate use of PPE during the care of suspected or confirmed cases of COVID-19 (OR = 11.295, CI = 2.183-59.429, P = .04)** **- staying in the same personnel break room as other HCWs without wearing a medical mask for more than 15 minutes (OR = 7.422, CI = 1.898-29.020, P = .04)** - Not consistently using PPE presents statistically increased odds of COVID-19 infection - Following the implementation of the additional infection control precautions (including mandatory masking), the number of infected HCWs decreased, and only 1 HCW became infected after April 15, 2020	- Low-moderate quality study - Risk of recall bias and social desirability bias - Pre-vaccine, pre-variant
			A 33-item questionnaire including possible exposure modes to SARS-CoV-2 in the hospital, was prepared, and interviews with the voluntary HCWs were conducted face-to-face (35 HCWs) or via telephone (150 HCWs) by the infection control nurses and the infection disease fellow			

Reference	Study Type	Population / Setting	Intervention / Exposure	Comparator	Results	Notes
Chang, Hur & Park, 2020 South Korea	Retrospective cohort study	Healthcare workers and patients in an acute care hospital (n= 303)	- 257 hospital workers and 46 patients came in contact with 29 COVID-19-positive patients between Feb 17 and April 11, 2020 - Mandatory masking for care providers and visitors - Mandatory masking for patients when outside their room or when others are inside their room - Outbreak investigations conducted by survey, with confirmation via patient medical records and CCTV recordings		- Exposures occurred in inpatient, outpatient, emergency, and non-patient care areas **- Of exposures: 291 (96.0%) wore a mask at the time of contact (4 with N95 masks, 123 with KF94 masks, and 165 with dental masks).** **- 161 (53.1%) were tested for COVID-19, of which 3 were confirmed as positive** - One (Case 5)) of the three confirmed patients is believed to have been infected through infected droplets after not wearing a mask while in contact with a confirmed COVID-19 patient (Case 2) - The other two patients were infected because our hospital failed to adhere strictly to the 2-week isolation guidelines due to the patient's request to move to a multiple-occupancy room.	- Low quality observation study - Weak connection between masks and low transmission rate - Risk of confounding - No discussion of potential community transmission
Contejean et al., 2021 France	Prospective cohort study	Healthcare workers in adult and pediatric acute care with confirmed COVID-19 between Feb 23 and April 10 2020 (n= 1344)	- In addition to specific precautions for patients' care, social distancing and universal masking with medical masks were advised for all hospital employees from 16 March - HCWs with positive COVID-19 test results were prospectively contacted by phone and invited to participate in the questionnaire - Data were collected on a standardized questionnaire on age, gender, profession, date of symptom onset, and exposure to SARS-CoV-2 in the 10 preceding days		- 1344 symptomatic HCWs were tested for SARS-CoV-2 from a total of 13 278 employees - Overall, 373 of 1344 (28%) tested positive, leading to an overall attack rate of 2.8% - The total number of cases peaked on 23 March, then decreased slowly until 10 April. **- the proportion of employees who declared wearing a mask always/most of the time at hospital increased from 17% (3/18) to 66% (206/312) after implementation of the universal masking policy on 16 March** - The majority recalled a contact without PPE with an index case. - Most employees declared wearing a mask always/most of the time at hospital, but 65 of 336 (19%) admitted removing masks during breaks in the presence of other colleagues (204/336 [61%] during lunch breaks)	- High quality study - Risk of recall bias and social desirability bias - Risk of confounding

Reference	Study Type	Population / Setting	Intervention / Exposure	Comparator	Results	Notes
					- SoonSoon after implementation of control measures in both hospitals (within one week), new infections in HCWs decreased, while the epidemic was still progressing in the community. - current adopted practices (medical masks in most patients and N95/FFP2 in aerosol-generating procedures) can largely protect HCWs against contaminations	
Contejean et al., preprint France	Case control study	Healthcare workers in acute care hospital (n= 564)	HCW who tested positive on rtPCR (HCW+) (n= 338)	Symptomatic HCW tested for SARS-CoV-2 on the same day, who had a negative rtPCR and a negative serological assessment performed at least 1 month after symptoms onset (HCW-). (n= 228)	- 336 (90%) completed the questionnaire, and were included as cases (HCW+) - Among 338 matched HCW with negative rtPCR, 247 (73%) had a serological assessment, and 228 (92%) tested negative and were considered controls - In the univariate analysis, occupational activities with direct patient facing or assignment to a COVID-19-dedicated unit were similar in cases and controls - cases reported more close contacts with suspected or confirmed COVID-19 patients without PPE. - Controls declared better compliance to mask wearing during occupational activities or in the presence of colleagues **- close contacts with colleagues without protection was independently associated with an increased risk of COVID-19 in HCW (OR 2.58 [1.49-4.60])** **- close contacts with suspected or confirmed COVID-19 patients without PPE (OR 3.87 [1.73-9.89]) was independently associated with an increased risk of COVID-19 in HCW.**	- High quality study - Risk of recall bias and desirability bias - Pre-vaccine, pre-variant (posted 2020)
Gohil et al., 2021	Retrospective cohort and cross-sectional	Healthcare workers in acute care hospital between	HCWs assigned to designated COVID-19 units and non-COVID-19	Matched control units not designated for COVID-19 care	- 60.8% (N = 52) of seropositive HCP never cared for a COVID-19 patient	- Moderate-high quality study

Reference	Study Type	Population / Setting	Intervention / Exposure	Comparator	Results	Notes
United States (California)	seroprevalence study	January 1- April 15, 2020 (n= 654) Seropositive: 87 Seronegative: 567	units that experienced outbreaks	or experiencing and outbreak	**- working in a unit with an HCP outbreak (OR 2.21, CI 1.28–3.81, p < 0.01) was significantly associated with COVID-19 infection** **- Working in a COVID-19 unit (with higher-level PPE precautions) was associated with a lower likelihood of COVID-19** (OR 0.53, CI = 0.30–0.94, p = 0.03) - **Among three outbreaks, forward transmission of COVID-19 occurred through unmasked interactions and gatherings (eg. breakroom, nursing station, skills classes)** - working in a COVID-19 unit (with contact, eye, and droplet-based mask precautions) was protective against infection and suggests that infection prevention protocols and practices are highly effective in preventing patient-to-HCP transmission.	- Risk of recall bias and desirability bias - pre-vaccine, pre-variant
			Universal masking was not yet in place and COVID-19 PPE (droplet masks, face shields, gowns and gloves) was used for patients suspected or confirmed to have COVID-19.			
Gras-Valenti et al., 2021 Spain	Pre/post-intervention observational study	Healthcare workers with confirmed COVID-19 in an acute care hospital (n= 142)	Intervention period (March 26-April 4, 2020) Post-universal masking	Pre-intervention period (March 16-25, 2020) SA in place but before masking)	- Of confirmed cases, 22 (15.5%) among HCP were healthcare associated, 81 (57.0%) were related to workplace relationships, and 39 (27.5%) were related to other relationships outside the workplace - Accumulated incidence (AI) of COVID-19 among HCP during the preintervention period until the implementation of the continuous use of a surgical mask was **22.3 for every 1000 HCP** - incidence of COVID-19 during the intervention period was **8.2 for every 1000 HCP**. The RR was 0.37 (0.25 to 0.55) and the AR was −0.014 (−0.020 to −0.009) - Effect of SA was did not reduce risk of COVID-19 infection -63% of COVID-19 cases in the pre-intervention period could have been prevented by masks	- Moderate-high quality study - Risk of recall bias and desirability bias - Risk of confounding from other IPC measures - pre-vaccine, pre-variant
			Universal masking for HCWs introduced March 19, 2020 State of alarm (SA) declared March 14, 2020 (movement and gathering restrictions) Survey and interviews conducted with confirmed cases			

Reference	Study Type	Population / Setting	Intervention / Exposure	Comparator	Results	Notes
					- the data specifically demonstrate that the use of **masks not only reduces the spread of SARS-CoV-2 from symptomatic persons but also reduces the transmission rate from asymptomatic persons**	
Habermann et al., 2021 United States (Minnesota)	Case series	Patients admitted to acute care for a non-COVID-19 indication between May 15 and June 15 N= 3043 tested for COVID-19 at admission	COVID-19 infection control policies in place: conversion of all patient rooms to single rooms, universal masking for staff and visitors, additional respiratory protection (N-95s or powered air-purifying respirators) for staff treating patients undergoing procedures classified as high risk for aerosol generation, masking of patients whenever they left their rooms, universal use of eye protection by staff when interacting with patients, limit of 1 visitor per hospitalized patient, and social distancing		**- 1310 patients tested negative at admission** **- No patient tested positive by PCR on or after day 7 of hospital admission when including all admitted eligible patients (95% confidence interval: 0.0%–0.3%) and no patients seroconverted (0.0%; 95% CI, 0.0%–0.9%)** - No patients were ultimately determined to have possible hospital-associated COVID-19 - We identified zero nosocomial infections, similar to results from another study of nosocomial COVID-19 in an overlapping time period, which also reported low (0.1%) risk of infection	Moderate quality study - High risk of confounding from other interventions - pre-vaccine, pre-variant - Impact of community transmission unclear
Ingram et al., 2021	Systematic Review	Single and combined IPC interventions	- Of 12 studies investigating PPE, 3 assessed universal masking policies (two amenable to meta-analysis; n=11684 – study design of 2 included studies) - No pooled pre-intervention rate - Pooled test positivity rate post-intervention = 24% (95% CI 3.4%-55.5%) [Note from R. Erdmann: The methods for this meta-analysis are not clear and the relationship between the pre- and post-intervention periods are not described. The authors do not draw conclusions based on this meta-analysis].			- MetaMeta-analysis for universal masking is very unclear - Very unclear relationship between original data and conclusions
Kociolek et al., 2021	Quasi-experimental study	HCWs at an acute care children's hospital testing	Post-intervention: April 14-May 25, 2020	Pre-intervention: March 24 – April 13, 2020	- 69 HCWs tested positive for SARS-CoV-2, 43 and 26 in the pre- and postintervention periods, respectively	- Moderate-high quality study

Reference	Study Type	Population / Setting	Intervention / Exposure	Comparator	Results	Notes
United States (Illinois)		positive for COVID-19 (n= 69)	- Universal masking policy requiring all staff, patients (excluding inpatients while in their private hospital room) and requiring all visitors to don an ASTM level 1 face mask was implemented on March 30, 2020.		- Of the 16 HCWs who reported exposure to another positive HCW, 15 (94%) occurred prior to universal **HCW masking** **- During the 3- and 6-week pre- and postintervention periods, respectively, 14.3 and 4.3 HCWs per week tested positive for SARS-CoV-2, and the test positivity rates were 18.4% and 9.0%** **- During the same pre- and postintervention periods, the overall SARS-CoV-2 positivity rates in our clinical microbiology laboratory were 10.7% and 12.8%, respectively** - Declines in HCW COVID-19 incidence and test positivity rate were observed concomitant with rising community COVID-19 activity during the postintervention period, suggesting masking protective	- Risk of confounding - Pre-vaccine, pre-variant - No statistical analysis of decreases -
Lan et al., 2020 United States (Massachusetts)	Quasi-experimental Retrospective cohort study	HCWs across Massachusetts community healthcare system	Intervention: April 1-20, 2020 Epidemic decline: April 21-May 6, 2020	Pre-intervention: March 17-31, 2020	- Pre-intervention, both the healthcare system and the state had strong increasing trends in the 7-day average COVID-19 incidence with overlapping slopes (0.96 (0.80 to 1.13) and 0.99 (0.92 to 1.07), respectively) -The temporal trend among Massachusetts residents kept increasing with a similar slope in the intervention phase (0.99 (0.94 to 1.05)), that of the healthcare system decreased and was negative (−0.68 (−1.06 to −0.31)) - During epidemic decline, following the states' pandemic peak, both populations' incidence showed overlapping negative slopes (−0.90 (−1.19 to −0.60) and −0.99 (−1.07 to −0.92)) -conclusion?	- Moderate-high quality study - Unclear individual compliance with policies
			The healthcare system implemented universal masking on 26 March and we allowed five more days for the policy to take effect based on the average COVID-19 incubation period.			

Reference	Study Type	Population / Setting	Intervention / Exposure	Comparator	Results	Notes
Pletz et al., preprint Germany	Retrospective descriptive study (outbreak investigation)	Jena University Hospital	- First nosocomial outbreak index case on March 16, 2020 that involved three HCWs and four patients - Screened 1311 HCWs between March 11 and May 12, 2020 - Mandatory masking implemented March 20 to control outbreaks		- 31 positive cases identified between March 11 and 19 - Four additional infections between March 20 and May 12, 2020 - Following mandatory mask implementation, the rate of new infections among HCWs dropped from 10.1% (31 of 306 screened HCW in this period) before to 0.4% (4 of 1,005 HCW screened in this period)	- Moderate quality study - Risk of confounding from single room policy and additional patient screening - risk of confirmation bias - pre-vaccine, pre-variant
Temkin et al., 2021 Israel	Pre/post-intervention retrospective study	All Israeli general hospitals between March 8 and May 1, 2020	Post-intervention: March 25 – May 1, 2020	Pre-intervention: March 8 – March 24, 2020	- Before the intervention, the number of HCWs in general hospitals infected at work or from an unknown source was increasing and peaked at 20 new infections per day - In the last 7 days of observations, the mean daily number of new infections was 1 and the mean prevalence of HCW in quarantine or isolation was 306 (despite increasing COVID-19 cases in the general population) - In total, 283 HCWs in general hospitals tested positive for SARS-CoV-2 from March 8 to May 1 whose source of infection was classified as work related **- Adjusted slope in COVID-19 incidence among HCWs infected at work, pre-intervention: 0.5 (0.2–0.8) (p= 0.001)** **- Adjusted slope in COVID-19 incidence among HCWs infected at work, post-intervention: −0.2 (−0.3 to −0.1) (p<.001)** - Change in adjusted slopes = −0.7 (−1.1 to −0.4) (p<.001)	- High quality study - pre-vaccine, pre-variant
			- Regular airborne/contact/droplet precautions prior to March 12, 2020 - March 25, the MOH mandated universal face mask use by all staff, patients, and visitors in general hospitals to prevent exposure to people with undiagnosed asymptomatic or mildly symptomatic COVID-19.			

Reference	Study Type	Population / Setting	Intervention / Exposure	Comparator	Results	Notes
					- Questioning about PPE use at the time of exposure revealed that three-quarters of transmissions from patients occurred when no PPE or partial PPE was used	
Tubiana et al., 2021 France	Prospective cohort study	HCWs in an acute care hospital, exposed to a COVID-19 case, between March 3rd 2020 and April 27th 2020	- High-risk exposure: i) face-to-face, within one meter and without protective surgical or FFP2/N95 mask, **and** ii) during a discussion or while the index had an episode of coughing or sneezing, **and** iii) in the 72 h prior to, or following the virological diagnosis, or during the symptomatic period of the index. - Universal masking implemented March 18, 2020		- 146 analysed contacts (HCWs) were exposed to 42 COVID-19 index (colleagues or patients) **- Exposure to patient decreased from 67.4% (56/83) before March 18th (the date of the widespread use of masks in the hospital) to 15.9% (10/63) after March, 18th.** - Following universal masking for HCWs on March 18th in our hospital, high-risk exposure to SARS-CoV-2-positive colleagues became predominant, making colleagues-to-colleagues transmission a potentially major route of infection [not sure what this sentence means, doesn't flow from the statement above?]	- Moderate quality study - Risk of confounding - pre-vaccine, pre-variant -
Walker et al., 2021 United States (Alabama)	Quasi-experimental, retrospective study	Patients admitted to acute care facility between April 6, 2020 -May 18, 2020	- Universal masking with ASTN level-1 procedural masks for all other healthcare workers and masking of all patients, began March 24 - High-risk exposure (HRE) were defined as exposure with both source and HCW not wearing a mask or being present in aerosol generating procedure without appropriate PPE		- 4,891 unique patients were tested for SARS-CoV-2, of whom 1,502 were designated as patients under investigation (PUI) and 3,389 as non-PUI. Among PUIs, 114 patients were positive (7.6%), and among non-PUIs, 26 were positive (0.77%) - Following implementation of our interventions we saw a decline in self-reported HRE for HCWs **- Institution of universal masking decreased the reported rate per patient-day of exposure without any mask by 73%, (RR 0.27, 95% CI 0.14-0.55)**, but was not associated with a significant change in exposure rates during aerosolizing procedure (RR 0.59, 95% CI 0.31 – 1.14)	- Moderate quality study - self-report tool creates risk of selection bias, recall bias, and selection bias - pre-vaccine, pre-variant
Wang et al., 2020	Pre/post-intervention	HCW with confirmed COVID-19 at Mass	In March 2020, MGB implemented a multipronged infection reduction strategy		- Of 9850 tested HCWs, 1271 (12.9%) had positive results for SARS-CoV-2	- Low quality study

Reference	Study Type	Population / Setting	Intervention / Exposure	Comparator	Results	Notes
United States (Massachusetts)	retrospective study	General Brigham, March 1-April 30, 2020	involving systematic testing of symptomatic HCWs and universal masking of all HCWs and patients with surgical masks 1. Pre-intervention (no masking): March 1-24, 2020 2. Transition period (HCW masking only): March 25-April 5, 2020 3. Lag period (symptom manifestation from infections before universal masking): April 6-10, 2020 4. Intervention period: April 11-30, 2020		**- During the preintervention period, the SARS-CoV-2 positivity rate increased exponentially from 0% to 21.32%, with a weighted mean increase of 1.16% per day and a case doubling time of 3.6 days (95% CI, 3.0-4.5 days)** **- During the intervention period, the positivity rate decreased linearly from 14.65% to 11.46%, with a weighted mean decline of 0.49% per day and a net slope change of 1.65% (95% CI, 1.13%-2.15%; P < .001)** - Universal masking at MGB was associated with a significantly lower rate of SARS-CoV-2 positivity among HCWs	- No adjustment for community trends and restrictions - High risk of confounding -
Williams et al., 2021 Canada (Ontario)	Prospective cohort study	Patients and residents who received direct care from a HCW with laboratory-confirmed COVID-19	- 1 October 2020 and 30 April 2021, any patient-facing HCW with laboratory-confirmed COVID-19 who worked during the period of communicability (POC) triggered a review of patient or resident assignment. - The period of communicability was defined as 48 hours prior to the onset of symptoms (pre-symptomatic) up to and including 10 days after onset of symptoms (symptomatic)		- 42 HCWs worked during the period of SARS-CoV-2 communicability, including 29(69%) asymptomatic and 13(31%) symptomatic **- 214 eligible protected patient and resident exposures** **- Among the 133(64%) patients or residents who completed at least 14 days of follow-up, 3 (2.3%) tested positive for SARS-CoV-2 (95% CI, 0.77-6.4).** - There was no significant difference in the risk of transmission if the HCW was working while symptomatic or not (4.3% vs 1.2%; P = .285). - This experience is consistent with evidence for other respiratory seasonal viruses showing that wearing a surgical mask as source control is highly protective against transmission to patients and residents in healthcare settings.	- Moderate-high quality study, not strong evidence - risk of confounding

	with medical mask required. Those who are unable to mask should be distanced from others.	with medical mask required. Those who are unable to mask should be distanced from others.	with medical mask required. Direct patients to exam room as quickly as possible.	with medical mask required. Direct patients to exam room as quickly as possible.

Masking policies in selected jurisdictions in the United States

The following table outlines States in the United States of America that **require** the use of masking in certain settings. Unspecified States have no requirements, although may have 'recommendations'.

Table 5. Continuous Masking Requirements by State

State	Requirement
California	Masks remain required for everyone, regardless of vaccination status, in specified high-risk settings, including but not limited to healthcare settings.
Colorado	Masks continue to be required in specified settings (certain healthcare and congregate settings). Employers, if within the definition of the congregate or healthcare settings where masks are required, must implement the face covering guidance set forth above.
Connecticut	Masks are no longer required in hospitals, long term care facilities, and other healthcare settings, but remain required in schools if the local school board or similar local authority institutes a requirement.
Delaware	Masks are recommended for individuals per CDC guidance, and remain required in specified settings (transportation, healthcare, etc.).
District of Columbia	Masks remain required in specified healthcare, education, transportation, and congregate settings.
Illinois	Individuals must continue to wear masks where required under federal law regardless of vaccination status.
Kentucky	Masks are recommended following exposure, for high-risk individuals, and for everyone when the community risk level is high.Masks continue to be required in certain limited settings (on public transportation, in healthcare settings, and others as specified).
Massachusetts	Masks are also required regardless of vaccination status in certain settings, including while using transportation services and in health care facilities.
New Jersey	Masks are still required in high-risk areas such as healthcare settings, public transportation, child care centers, correctional facilities, and homeless shelters.

New Mexico	Masks remain required in certain healthcare and congregate settings.
New York	Masks remain required in schools, healthcare facilities, and a few other specified settings.
Oregon	Masks remain required in healthcare settings, certain congregate settings, on public transportation, and other limited settings as specified.
Puerto Rico	Masks remain required in healthcare facilities, assisted living facilities for the elderly, centers that tend to individuals with intellectual disabilities, correctional facilities, public transit, childcare centers, and public and private schools when inside a closed facility.
Washington	Masks continue to be required in some settings, including health care, long-term care and correctional facilities.

Reference: https://www.littler.com/publication-press/publication/facing-your-face-mask-duties-list-statewide-orders (updated June 15, 2022).

Methods

Literature Search

A literature search for the primary research was conducted by Rachel Zhao from Knowledge Resources Services (KRS) within the Knowledge Management Department of Alberta Health Services. KRS searched databases for articles published from 2020-2022 and included OVID MEDLINE, EBSCOHost CINAHL and medRxiv. The full search strategy is included below; briefly, the strategy involved combinations of keywords and subject headings based on the following concepts:

- Masks (includes term for continuous / universal masking)
- COVID-19
- Healthcare settings
- Outbreak management / infection prevention and control

Articles identified by KRS in their search were initially screened by the librarian for obvious irrelevance based on the information in the title and abstract. After the initial screen for relevance, 135 articles were identified by KRS with references and abstracts provided for further review. 49 articles were excluded from the review based on the information in the title and abstract, and a further 64 were excluded in accordance with the inclusion/exclusion criteria (Table 6) following full text review. 22 articles were included in the narrative synthesis.

Table 6. Inclusion and exclusion criteria for results of the literature search

Inclusion Criteria	**Exclusion Criteria**
- Original research - peer reviewed or pre-print. - Date of research: 2021-present - Participants: healthcare workers and hospitalized patients - Exposure/comparator: **hospital-based universal masking policies (ie. masking for HCWs, patients, and visitors at all times within the facility)** - Outcome: Any (outbreak management; transmission of COVID-19 from HCW-to-patient, patient-to-patient, or patient-to-HCW; incident COVID-19 rate) - Comparative study	- Articles written as commentaries, opinion pieces, editorials, narrative reviews, qualitative methodology, - Animal studies - Diseases other than COVID-19 - Mask efficacy - 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

- Designs of interest: any quantitative methodology - English language only - Any jurisdiction - Published after 2020	

The jurisdictional scan was conducted as a search of publicly available documents and supporting news stories from comparable jurisdictions to Alberta. Information was extracted regarding the presence or absence of a mask mandate for the general population; the presence or absence of a mask mandate for visitors to healthcare facilities; and the presence or absence of a mask mandate for staff working in the facility. Policy information was sought from the following jurisdictions, with additional jurisdictions added if information was identified during the course of the search:

Canada: British Columbia, Saskatchewan, Manitoba, Ontario, Quebec, New Brunswick, Nova Scotia, Prince Edward Island, Newfoundland, Yukon, Northwest Territory, Nunavut

United States: United States Centers for Disease Control and Prevention

Europe: European Centre for Disease Control; England, Scotland, Northern Ireland, Wales

Critical Evaluation of the Evidence

Exclusion criteria for study quality were adapted from the Mixed Methods Appraisal Tool (MMAT) (Hong et al., 2018). Potential articles were evaluated on three criteria: 1) Peer reviewed or from a reputable source; 2) Clear research question or issue; 3) Whether the presented data/evidence is appropriate to address the research question. Preprints and non peer-reviewed literature (such as commentaries and letters from credible journals) are not excluded out of hand due to the novelty of COVID-19 and the speed with which new evidence is available.

Table 7 below is a narrative summary of the body of evidence included in this review. The categories, format, and suggested information for inclusion were adapted from the Oxford Centre for Evidence-Based Medicine, the Cochrane Library, and the AGREE Trust (Urwin, Gavinder & Graziadio, 2020; Viswanathan et al, 2012; Wynants et al., 2020; Brouwers et al., 2010).

Table 7. Narrative overview of the literature included in this review.

	Description

Volume	1 systematic review was included (0 were pre-review); 4 prospective cohort studies were included (1 were pre-review); 2 retrospective cohort studies were included (0 were pre-review), 3 case-control studies were included (2 were pre-review); 5 retrospective observational/descriptive studies were included (1 was pre-review); 6 pre-/post-intervention descriptive studies were included; 1 case series was included.
Quality	In general, the evidence identified and included from the primary literature was overall of low quality. The studies with a clear quantitative methodology (eg. the cohort studies, case-control, and quasi-experimental studies) were generally of reasonable quality; however, the outbreak investigation reports were low quality. The epidemiological investigation reports often used HCW self-report methods and retrospective surveys to assess PPE use among the study population. These methods are at high risk of recall bias and social desirability bias, which may result in an overestimate of the effectiveness of the intervention. The observational methodologies in the body of evidence are insufficient to show the effect of universal masking. In most cases, there was no controlled comparator group to show the effect of masks specifically. The hospitals where universal masking was implemented often concurrently introduced a suite of IPC measures that interact to protect individuals in the hospital (eg. enhanced cleaning measures; enhanced screening, testing, and isolation procedures; social distancing measures; gathering restrictions; and visitor restriction). In many cases, these additional interventions were not adjusted in the analysis and introduce a very high risk of confounding in these studies. In the case of outbreak investigations, the introduction of masks may be accompanied by increased staff awareness of circulating COVID-19, which may introduce prevention behaviours that aren't accounted for in the analysis and further confounding the results.
Applicability	The included evidence was nearly entirely collected during 2020, when the efficacy of masks was still under debate and universal masking policies were considered a major policy response to the pandemic. Since masks have become generally acceptable and no hospital has published the results of lifting their universal masking policy, no new

	evidence has been published to confirm the effectiveness of mask policies in the face of high community transmission, COVID-19 variants of concern, and high vaccination rates among healthcare workers. In addition, every jurisdiction experienced the start of the pandemic in a different way. Alberta, for example, had a very mild first wave that resulted in fewer than 10000 reported cases; by comparison, New York City and Northern Italy experienced high caseloads that overwhelmed healthcare resources. Differences in community transmission and public health measures may also impact the effectiveness of a hospital mask mandate.
Consistency	The collected evidence is very consistent – every includable article reports that universal masking policies are an effective tool to limit COVID-19 spread within a hospital setting.

Search Strategy

Ovid MEDLINE(R) ALL 1946 to June 09, 2022

#	Searches	Results
1	exp masks/ or respiratory protective devices/	14153
2	(mask or masks or respiratory protective device* or KN95 or FFP2 or FFP3 or N95 or P2 or "enhanced respiratory and contact precautions" or E-RCP or respiratory protection* or filtering face piece* or filtering facepiece*).kf,ti. or (mask or masks or respiratory protective device* or KN95 or FFP2 or FFP3 or N95 or P2 or "enhanced respiratory and contact precautions" or E-RCP or respiratory protection* or filtering face piece* or filtering facepiece*).ab. /freq=2	37292
3	((continuous or universal or mandat*) adj3 mask*).kf,tw.	882
4	or/1-3	43167
5	exp Coronavirus/ or Coronavirus Infections/ or COVID-19/ or (covid 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.	281811
6	exp academic medical centers/ or exp ambulatory care facilities/ or exp hospitals/ or Inpatients/ or exp residential facilities/	470033
7	exp Hospital Units/	128961
8	Emergency Service, Hospital/	82521
9	(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,ti. or (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*).ab. /freq=2	926722
10	or/6-9	1247897
11	4 and 5 and 10	512
12	Disease Outbreaks/	87970
13	Cross Infection/	60242
14	Infection Control/	28375

15	(outbreak* or cross infection* or health care associated infection* or healthcare associated infection* or hospital infection* or in-hospital infection* or nosocomial infection*).kf,ti. or (outbreak* or cross infection* or health care associated infection* or healthcare associated infection* or hospital infection* or in-hospital infection* or nosocomial infection*).ab. /freq=2	77422
16	(hospital* adj3 transmi*).kf,tw.	1316
17	(infect* adj3 (prevent* or control*)).kf,tw.	110026
18	or/12-17	275723
19	11 and 18	210
20	limit 19 to (english language and yr="2020 -Current")	191
21	remove duplicates from 20	189

CINAHL

	Query	Limiters/Expanders	Results
S19	S4 AND S7 AND S10 AND S17	Limiters - Published Date: 20200101-20221231; English Language Expanders - Apply equivalent subjects Search modes - Boolean/Phrase	237
S18	S4 AND S7 AND S10 AND S17	Expanders - Apply equivalent subjects Search modes - Boolean/Phrase	253
S17	S11 OR S12 OR S13 OR S14 OR S15 OR S16	Expanders - Apply equivalent subjects Search modes - Boolean/Phrase	117,526
S16	TI (infect* N3 (prevent* or control*)) OR AB (infect* N3 (prevent* or control*))	Expanders - Apply equivalent subjects Search modes - Boolean/Phrase	33,931
S15	TI hospital* N3 transmi* OR AB hospital* N3 transmi*	Expanders - Apply equivalent subjects Search modes - Boolean/Phrase	569

S14	TI (outbreak* or cross infection* or health care associated infection* or healthcare associated infection* or hospital infection* or in-hospital infection* or nosocomial infection*) OR AB (outbreak* or cross infection* or health care associated infection* or healthcare associated infection* or hospital infection* or in-hospital infection* or nosocomial infection*)	Expanders - Apply equivalent subjects Search modes - Boolean/Phrase	33,145
S13	(MH "Infection Control")	Expanders - Apply equivalent subjects Search modes - Boolean/Phrase	29,300
S12	(MH "Cross Infection")	Expanders - Apply equivalent subjects Search modes - Boolean/Phrase	26,552
S11	(MH "Disease Outbreaks")	Expanders - Apply equivalent subjects Search modes - Boolean/Phrase	41,386
S10	S8 OR S9	Expanders - Apply equivalent subjects Search modes - Boolean/Phrase	828,872
S9	TI (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 hemodialysis unit* or haemodialysis unit* or intensive care unit* or burn units* or emergency department* 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 AB (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 hemodialysis unit* or haemodialysis unit* or intensive care unit* or burn units* or emergency department* or coronary care unit* or intensive care unit* or recovery room* or respiratory care unit* or nursing	Expanders - Apply equivalent subjects Search modes - Boolean/Phrase	653,884

	station* or operating room* or self-care unit* or ER or ED)		
S8	(MH "Academic Medical Centers") OR (MH "Ambulatory Care Facilities+") OR (MH "Hospital Units+") OR (MH "Hospitals+") OR (MH "Residential Facilities+")	Expanders - Apply equivalent subjects Search modes - Boolean/Phrase	343,020
S7	S5 OR S6	Expanders - Apply equivalent subjects Search modes - Boolean/Phrase	95,251
S6	TI (covid 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) OR AB (covid 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)	Expanders - Apply equivalent subjects Search modes - Boolean/Phrase	90,502
S5	(MH "COVID-19+") OR (MH "SARS-CoV-2") OR (MH "Coronavirus") OR (MH "Coronavirus Infections")	Expanders - Apply equivalent subjects Search modes - Boolean/Phrase	35,893
S4	S1 OR S2 OR S3	Expanders - Apply equivalent subjects Search modes - Boolean/Phrase	14,518
S3	TI ((continuous or universal or mandat*) N3 mask*) OR AB ((continuous or universal or mandat*) N3 mask*)	Expanders - Apply equivalent subjects Search modes - Boolean/Phrase	328

S2	TI (mask or masks or respiratory protective device* or KN95 or FFP2 or FFP3 or N95 or P2 or "enhanced respiratory and contact precautions" or E-RCP or respiratory protection* or filtering face piece* or filtering facepiece*) OR AB (mask or masks or respiratory protective device* or KN95 or FFP2 or FFP3 or N95 or P2 or "enhanced respiratory and contact precautions" or E-RCP or respiratory protection* or filtering face piece* or filtering facepiece*)	Expanders - Apply equivalent subjects Search modes - Boolean/Phrase	0
S1	(MH "Masks") OR (MH "Respiratory Protective Devices+")	Expanders - Apply equivalent subjects Search modes - Boolean/Phrase	5,415

medRxiv

"continuous masking" and posted between "01 Dec, 2021 and 10 Jun, 2022"
"continuing masking" and posted between "01 Dec, 2021 and 10 Jun, 2022"
"universal masking" and posted between "01 Dec, 2021 and 10 Jun, 2022"
"mask mandate" and posted between "01 Dec, 2021 and 10 Jun, 2022"
"mandatory masking" and posted between "01 Dec, 2021 and 10 Jun, 2022"
for abstract or title: hospital* mask* (match all words) and posted between "01 Dec, 2021 and 10 Jun, 2022"
for abstract or title: nursing home* mask* (match all words) and posted between "01 Dec, 2021 and 10 Jun, 2022"
for abstract or title: long term care mask* (match all words) and posted between "01 Dec, 2021 and 10 Jun, 2022"

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