

Emerging Evidence on COVID-19

Evidence Brief on Infection Risk from Eye Exposures to Inform Contact and Droplet Precautions

Introduction

What is the available evidence on eye protection (in addition to standard medical masks and respirators) to prevent COVID-19 infection transmission to healthcare workers?

COVID-19 is a respiratory infection that is primarily transmitted by droplets, and possibly aerosols, during close unprotected interactions (Vuorinen et al., 2020). Speaking, coughing, and sneezing by symptomatic patients can lead to infection transmission due to small virus-laden droplets (and possibly aerosols) being expelled into the healthcare environment (Liu et al., 2020; Loh et al., 2020; Ong et al., 2020; Vuorinen et al., 2020). Effective and appropriate personal protective equipment provide barriers that prevent the transmission of infection from patients to healthcare workers.

This evidence brief highlights available evidence to support the use of eye protection among healthcare workers to reduced COVID-19 infection published until June 18, 2020.

Key Points

- No studies to date have specifically investigated or reported on SARS-CoV-2 infection due to exposure of ocular surfaces. Evidence that support the use of eye protection by healthcare workers to minimize infection transmission of coronaviruses is outlined in Table 1.
 - ACE-2 receptors, a cellular receptor for SARS-CoV-2 virus attachment are found in human eye tissue. Numerous studies, including a systematic review, provide molecular biological evidence that SARS-CoV-2 can use optical tissues (i.e. the eye) as a portal of entry to infect human hosts (Aiello et al., 2020; Lange et al., 2020; Ma et al., 2020; Zhang, Jin, & Lei, 2020; Zhou et al., 2020).
 - Exposure data from multiple hospitals during the SARS outbreak in Ontario, Canada provide observational data that report eye protection reduced the incidence of SARS infections among responding healthcare workers (Raboud et al., 2010).
- Public Health Agency of Canada COVID-19 Infection Prevention and Control guidance for healthcare workers recommend (PHAC & Canada, 2020) – last updated May 19, 2020.
 - The use of contact AND droplet precautions (i.e. use of gloves, masks, face shields, and goggles) when healthcare workers interact with patients suspect or confirmed with COVID-19 infection.

- Contact AND droplet precautions are to be used by healthcare workers 1) with patients presenting with a fever and/or new or worsening cough or acute respiratory illness, 2) entering patient rooms, or 3) in proximity to any aerosol generating procedure - regardless of acute respiratory infection symptom presentation in the patient.
- Active screening activities are to be implemented at healthcare worker and patient entry points within healthcare settings. Screeners are to be protected with transparent barriers or PPE (e.g. gloves, gown, mask, and face or eye protection) if a transparent barrier cannot be put in place.
- Point of care risk assessments be applied (based on the patient, the interaction, and the task) to determine additional precautions necessary for ALL patient and visitor at this time (PHAC & Canada, 2020).
- Emerging evidence on serological testing of hospital workers reveal IgG positivity to be linked to geographical prevalence of the infection in a region (Sandri et al., 2020). It may be beneficial for healthcare workers to consider COVID-19 prevalence within the patient catchment areas when assessing transmission risk and use of eye protection.

Overview of the Evidence

Observational study data on the protective effects of eye protection specific to COVID-19 transmission in healthcare is lacking. Yet, molecular biology evidence does provide evidence to support the plausibility of SARS-CoV-2 infection using the host eye as a portal of entry. There are knowledge gaps in the research that estimate infection transmission risks to healthcare workers related to eye protection.

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INFECTION VIA OCULAR EXPOSURE

Table 1: Literature on infection transmission risk from ocular surface exposures.

Publication Title	Key Outcomes	Reference
Primary Literature		
<p>Enhanced Contact Investigations for Nine Early Travel-Related Cases of SARS-CoV-2 in the United States.</p>	<p>The study reports on varied personal protection equipment (PPE) use among healthcare workers attending to the early travel related cluster of COVID-19 cases in the US.</p> <p>This is the only study (to date) to consider and provide data on selective personal protection equipment use among healthcare workers during COVID-19.</p> <p>Relative risk of COVID-19 infection based on eye protection vs. no eye protection can NOT be estimates as no secondary cases among healthcare workers were identified.</p>	<p>(Burke et al., 2020)</p>
<p>Expression of SARS-CoV-2 receptor ACE2 and TMPRSS2 in human primary conjunctival and pterygium cell lines and in mouse cornea</p> <p>Expression of the COVID-19 receptor ACE2 in the human conjunctiva</p> <p>Distribution and clinical significance of ACE2, a key receptor of 2019-nCoV, in ocular tissues</p> <p>ACE2 and TMPRSS2 are expressed on the human ocular surface, suggesting susceptibility to SARS-CoV-2 infection</p>	<p>Human eye tissue is found to express ACE-2 receptors, cellular receptors for SARS-CoV-2, thus confirming the ability of the virus to infect a host via the eye.</p>	<p>(Ma et al., 2020), (Lange et al., 2020), (Zhang et al., 2020), (Zhou et al., 2020)</p>
<p>Risk factors for SARS transmission from</p>	<p>According to a multicenter investigation of a past SARS outbreak in Toronto, inconsistent goggle and eye protection when</p>	<p>(Raboud et al., 2010)</p>

patients requiring intubation: a multicentre investigation in Toronto, Canada	entering a patient room increased healthcare worker infection risk (n=624). A statistically significant association between eye protection and infection were identified, suggesting conjunctiva could have been a portal of pathogen entry.	
Publication Title	Key Outcomes	Reference
Key Commentaries and Reviews		
Physical interventions to interrupt or reduce the spread of respiratory viruses. Part 1 - Face masks, eye protection and person distancing: systematic review and meta-analysis	The systematic review was unable to identify any reports from the 2003 SARS outbreak that assessed the use of eye protection and infection prevention.	(Jefferson et al., 2020)
Physical Distancing, Face Masks, and Eye Protection to Prevent Person-Person COVID-19 Transmission: A Systematic Review and Meta-Analysis	A systematic review and meta-analysis by Chu et al., examine the available evidence from observational studies on coronavirus (SARS-CoV-2, MERS-CoV, SARS) transmission risk based on eye protection. The review concludes eye protection alongside mask/respirator use is associated with a reduction in coronavirus infection transmission (Risk Difference of -10.6% (95% CI -12.5 to -7.7) and adjusted odds ratio 0.22, 95% CI 0.12 to 0.39 respectively with low certainty). However, SARS-CoV-2 was not considered in the eye protection risk estimates as this evidence does not presently exist.	(Chu et al., 2020)
Coronavirus disease 2019 (SARS-CoV-2) and colonization of ocular tissues and secretions: a systematic review	A systematic review by Aiello summarizes the available information on the presence of SARS-CoV-2 in cornea, conjunctiva, lacrimal, sac and tears. The review confirms SARS-CoV-2 can be present and infect eye tissue, and therefore may use ocular structures as an additional transmission route.	(Aiello et al., 2020)
2019-nCoV transmission through the ocular surface must not be ignored	Commentary where authors refer to a media report (in Chinese) where infection transmission in a worker wearing an N95 mask but no eye protection was reported to have occurred.	(Lu, Liu, & Jia, 2020)

Methods:

A daily scan of the literature (published and pre-published) is conducted by the emerging sciences group, PHAC. The scan has compiled COVID-19 literature since the beginning of the outbreak and is updated daily. Searches to retrieve relevant COVID-19 literature are conducted in Pubmed, Scopus, BioRxiv, MedRxiv, ArXiv, SSRN, Research Square and cross-referenced with the literature on the WHO COVID literature list, and COVID-19 information centers run by Lancet, BMJ, Elsevier and Wiley. The daily summary and full scan results are maintained in a RefWorks database and an excel list that can be searched. Targeted keyword searching was conducted within these databases to identify relevant citations on COVID-19 and SARS-COV-2. An additional target keyword search was conducted on Pubmed to identify relevant citation not specific to COVID-19 and SARS-COV-2. Search terms used included: Goggle. ocular, eye, and ACE2

Each potentially relevant reference was examined to confirm it had relevant data and relevant data is extracted into the review.

This review contains research published up to June 20, 2020.

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