



Rapid Review: What is the role of indirect transmission (i.e. surfaces/fomites) on COVID-19?

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Executive Summary

Background

As physical distancing measures begin to be relaxed across the country, it is important to understand the role indirect transmission may play in the community setting.

This rapid review was produced to support public health decision makers' response to the coronavirus disease (COVID-19) pandemic. This review seeks to identify, appraise, and summarize emerging research evidence to support evidence-informed decision making.

This rapid review is based on the most recent research evidence available at the time of release. This version includes evidence available up to May 11, 2020.

In this rapid review, we provide the most recent research evidence to answer two key questions.

Question 1: Do facial coverings reduce indirect or community transmission?

Key Points

- Based on the current data, there is insufficient evidence to support the role of facemasks on their own to reduce indirect/community transmission of COVID-19.
- As of May 11, 2020, only one modelling study has been conducted specific to COVID-19 to address the question of whether facemasks reduce the spread of the virus in the community. This study suggests that mask wearing may reduce disease transmission; however, the certainty of the evidence is very low and further evidence may very likely change these estimates.
- Several reviews and studies have explored the role of facemasks to reduce community spread of other influenza-like illnesses and there is little to no evidence to suggest that mask wearing on its own reduces community spread. The quality of the evidence is low to moderate, findings are consistent.
- There is some suggestion that mask wearing may be more effective if initiated early in a pandemic, and mask wearing must be combined with other infection-control procedures such as hand hygiene.

Overview of the Evidence and Knowledge Gaps

- Evidence specific to COVID-19 is lacking and this question should be reviewed again as more information becomes available from around the world.
- It is unknown if findings from other influenza-like illnesses are applicable to COVID-19.
- Among existing studies, mask wearing was often combined with other infection control measures which should continue to be encouraged (e.g., hand hygiene).
- Although several syntheses exist, there is a large amount of overlap of single studies within the reviews. This overlap results in counting outcomes multiple times and may lead to an overestimation of the true relationship.
- Within studies of other influenza-like illnesses, the settings varied substantially across included trials, such as university residences, hospital visitors, and religious pilgrimages, thus the applicability of the evidence to different contexts is questionable.

Question 2: What is known about how long the virus can survive with potential for infection on surfaces outdoors compared to indoors?

Key Points

- The likelihood of transmission of COVID-19 outdoors or indirectly on outdoor surfaces is not known.
- There is currently no evidence specific to COVID-19 to tell us how long the virus can live and be transmitted on outdoor compared to indoor surfaces.
- One synthesis of other coronaviruses suggest that transmission is unlikely through surface, ground or drinking water. The quality of the evidence is low; findings are consistent.

Overview of the Evidence and Knowledge Gaps

- Evidence specific to COVID-19 transmission is lacking. This question should be revisited as more evidence becomes available.
- The transferability of available evidence from other coronaviruses to COVID-19 is not known.
- A number of laboratory-based studies have shown that there is the possibility to transmit coronaviruses generally, and COVID-19 specifically, through droplets, saliva and fecal-oral route which may be relevant to outdoor transmission if the virus is transmitted to high-touch objects outdoors such as gates, benches or play structures.
- There is some evidence to suggest that environmental conditions, such as temperature, may play a role in virus transmission, which may be particularly relevant to outdoor transmission. Increasing temperature is associated with lower COVID-19 incidence in ecological studies; however, confidence in these findings is low due to the low-quality evidence, and further high-quality evidence is likely to change these findings.

Methods

Research Questions

What is the role of indirect transmission (i.e. surfaces, fomites) on COVID-19:

- 1) Do facial coverings reduce indirect or community transmission?
- 2) What is known about how long the virus can survive with potential for infection on surfaces outdoors compared to indoors?

Search

On May 8, 2020, the following databases were searched for evidence pertaining to how long the SARS-CoV-2 virus can survive with potential for infection on outdoor compared to indoor surfaces. On 11 May 2020, the same databases were searched for evidence pertaining to the role of facial coverings in reducing indirect and community transmission.

- Cochrane: [Coronavirus \(COVID-19\) Special Collections](#)
- Cochrane [Rapid Reviews Question Bank](#)
- Joanna Briggs Institute [COVID-19 Special Collection](#)
- Oxford [COVID-19 Evidence Service](#)
- Oxford [COVID-19 Evidence Service: Current Questions Under Review](#)
- [Turning Research Into Practice \(TRIP\)](#)
- [Guidelines International Network \(GIN\)](#)
- [LitCovid](#)
- World Health Organization [Global literature on coronavirus disease](#)
- [CovidReview](#)
- [Prospero](#)
- [COVID-19 Evidence Alerts](#) from McMaster PLUS™
- [Public Health +](#)

A copy of the search strategy is available on request.

Selection Criteria

The search first included recent, high-quality syntheses. If no syntheses were found, single studies were included. English-language, peer-reviewed sources and sources published ahead-of-print before peer review were included. Grey literature and surveillance sources were excluded.

- 1) Do facial coverings reduce indirect or community transmission?
- 2) What is known about how long the virus can survive with potential for infection on surfaces outdoors compared to indoors?

	Inclusion Criteria	Exclusion Criteria
Population	Surfaces	
Intervention	Outdoor surfaces	
Comparisons		
Outcomes	Virus alive with potential for transmission/infection	

Data Extraction and Synthesis

Data on study design, setting, location, population characteristics, interventions or exposure and outcomes were extracted when reported. We synthesized the results narratively due to the variation in methodology and outcomes for the included studies.

We evaluated the quality of included evidence using critical appraisal tools as indicated by the study design below. Quality assessment was completed by one reviewer and verified by a second reviewer. Conflicts were resolved through discussion.

Study Design
Synthesis

Critical Appraisal Tool
Health Evidence™ [Quality Appraisal Tool](#)

Completed quality assessments for each included study are available on request.

Findings

This document includes eight completed syntheses, one in progress synthesis, and one completed single study for a total of ten publications included in this evidence review, addressing two distinct questions. The quality of the evidence included in this review is as follows:

Question 1: Do facial coverings reduce indirect or community transmission?

		Total	Quality of Evidence
Syntheses	Completed Reviews	5	1 Low 4 Moderate
	In Progress Reviews	1	-
Single Studies	Completed	1	-

Question 2: What is known about how long the virus can survive with potential for infection on surfaces outdoors compared to indoors?

		Total	Quality of Evidence
Syntheses	Completed Reviews	3	1 Low 2 Moderate
Single Studies	Completed	0	-

Warning

Given the need to make emerging COVID-19 evidence quickly available, many emerging studies have not been peer reviewed. As such, we advise caution when using and interpreting the evidence included in this rapid review. We have provided a summary of the quality of the evidence as low, moderate, or high to support the process of decision making. Where possible, make decisions using the highest quality evidence available.

A number of mathematical modelling studies are emerging related to COVID-19. While these studies may provide important estimates, their ultimate usefulness depends on the quality of the data that is entered into the model. Given the constantly evolving nature and changing understanding of COVID-19 around the world, a high degree of caution is warranted when interpreting these studies, and when presented, include the range of confidence intervals rather than single effect estimates.

Question 1: Do facial coverings reduce indirect/community transmission?

Table 1: Syntheses

Reference	Date Released	Description of included studies	Summary of Findings	Quality Rating: Synthesis	Quality Rating: Included Studies
Gupta, M., Gupta, K., Gupta, S.. (2020). The use of facemasks by the general population to prevent transmission of Covid 19 infection: A systematic review. Preprint	May 6, 2020 (Date of search Apr 2020)	14 studies from around the world published between 2008-2019 <ul style="list-style-type: none"> • 7 community-based randomized controlled trials (none specific to COVID-19) • 3 experimental studies (none specific to COVID-19) • 2 observational studies (both from SARS) • 2 modelling studies (both H1N1) 	Findings from randomized trials are conflicting; studies that found positive effects typically also included hand hygiene interventions, and adherence to proper mask wearing appears important. Experimental studies found some benefits of wearing masks to reduce exposure, unclear translation to real world settings. Conflicting evidence from observational studies. Data suggest that those who wear masks had lower risk of SARS, but population-level adherence to mask wearing was low. Modelling studies suggest adherence must be high amongst both symptomatic and asymptomatic individuals in order for mask wearing to be effective at a population level.	Moderate	Not reported
Usher Network for COVID-19 Evidence Reviews (2020). Summary: What is the effectiveness of face masks in preventing respiratory transmission in the community?	Apr 20, 2020 (Date of search not given)	<i>Are masks effective in reducing community transmission of influenza-like illnesses</i> <ul style="list-style-type: none"> • 4 systematic reviews (2020); two included 7 RCTs of influenza-like illness in the community, one included 10 RCTs in pandemic influenza • All included non-COVID studies 	Three meta-analyses were re-run to only include community-based trials; no significant effects of facemask use were found (ORs: 0.92 (0.87, 1.07), 0.97 (0.79, 1.18) and 0.94 (0.75, 1.19) There was variability across studies in terms of type of mask used and other control measures included. Findings suggest that more consistent mask use leads to a larger effect, although still not statistically significant. Mask use on its own is not effective; it must be combined with other infection control measures such as handwashing.	Moderate	Low
Marasinghe, KM. (2020). Concerns around public health recommendations on face mask use among individuals who are not	Apr 10, 2020	No studies included	No studies on the effectiveness of facemasks to reduce the spread of COVID-19 were found. Studies exploring the effectiveness of facemasks for other infectious diseases were not included.	Low	N/A

medically diagnosed with COVID-19 supported by a systematic review search for evidence. <i>Preprint.</i>					
ECRI Institute (2020). Cloth face coverings worn by public to reduce transmission of viral respiratory infection.	Apr 2020 (Date not specified; search to Apr 6, 2020)	2 published laboratory studies from 2020 <ul style="list-style-type: none"> Bae et al 2020, n=4 (South Korea) Ma et al. 2020, simulation study (China) No clinical or epidemiologic studies of COVID-19 were found	Laboratory studies suggest cloth masks may filter avian influenza virus but were not effective in reducing particle spread by 4 COVID-19 patients who coughed while wearing a mask. Findings are extremely limited and do not necessarily translate to real-world community settings.	Moderate	Not reported
Brainard, JS., Jones, N., Lake, I., Hooper, L., Hunter, P. (2020). Facemasks and similar barriers to prevent respiratory illness such as COVID-19: A rapid systematic review <i>Preprint.</i>	Apr 6, 2020 (Date of Search, Jan 31, 2020)	31 included studies published 1998-2019; none included COVID-19 <ul style="list-style-type: none"> 12 cluster-RCTs 3 cohort studies 5 case-control 10 cross-sectional A variety of settings, including schools, university residences, households. 19 studies reported influenza-like illness, 12 reported general symptoms.	A meta-analysis combining data from 28 of the included studies found no effect of wearing a facemask, OR = 0.94, 95% CI: 0.75 to 1.19, low-certainty evidence. Stronger effects were seen in specific settings, including visitors to hospitals, and in households with an infected household member.	Moderate	Low

Table 2: In-Progress Syntheses

Title	Anticipated Release Date	Description of document
Oxford COVID-19 Evidence Service. (2020). What forms of non-standard PPE are there (e.g. home-made masks) and what is the evidence of their efficacy?	Not reported	Listed in question bank only, no details given

Table 3: Single Studies

Title	Date Released	Study Design	Population	Setting	Summary of Findings	Quality Rating:
Eikenberry, SE., Mancuso, M., Iboi, E., Phan, T., Eikenberry, K., Kuang, Y., Kostelich, E., Gumel, AB. (2020). To mask or not to mask: Modeling the potential for face mask use by the general public to curtail the COVID-19 pandemic <i>Infectious Disease Modelling</i> , 5, 293-308	May 2, 2020	Modeling	General population (symptomatic and asymptomatic)	New York and Washington State	The model suggests that with 50% uptake of a 50% effective mask, disease transmission rate would be cut in half. With widespread adoption (80%) even a 20% effective mask would reduce disease transmission by 30%. Benefits are greater when mask wearing is adopted earlier in a pandemic.	-

Question 2: What is known about how long the virus can survive with potential for infection on surfaces outdoors compared to indoors?

Table 4: Syntheses

Title	Date Released	Surface	Description of Included Studies	Summary of Findings	Quality Rating: Synthesis	Quality Rating: Included studies
Usher Network for COVID-19 Evidence Reviews. (2020, May 8). Review: What is the evidence for outdoor transmission of SARS-CoV-2?	May 8, 2020 (Search to Apr 30, 2020)	Outdoor transmission	<p>26 studies were found, all published in 2020. Few details on individual studies are included</p> <ul style="list-style-type: none"> • 10 epidemiological studies • 6 microbiological studies • 1 review and 5 single mechanistic studies • 4 ecological studies exploring correlation between virus transmission and environmental 	<p>There is no direct evidence as to how long the virus can survive and/or is transmissible on outdoor surfaces.</p> <p>Epidemiological studies suggest fecal-oral transmission is possible, which is relevant as this may be a source of spread on outdoor surfaces. There is no direct evidence to support that transmission this way has occurred.</p> <p>Microbiological studies suggest the virus may persist longer at low temperatures and in wet conditions, however real-world applicability is unknown.</p> <p>Mechanistic studies using modelling techniques in laboratory settings found emitted droplets may be greater during speech and exercise vs. breathing at rest.</p> <p>Three ecological studies found a negative correlation between air temperature and COVID-19 incidence. One study found a biphasic relationship, with incidence decreasing above and below 10 degrees C.</p>	Moderate	Low
La Rosa, G., Bonadonna, L., Lucentini, L., Kenmoe, S., Suffredini, E. (2020). Coronavirus in water	Apr 28, 2020 (Search to Feb 23, 2020)	Water	<p>4 studies (2005-2016) explored survival of coronaviruses in water environments</p> <p>5 studies (2005 – 2017) explored occurrence of human pathogenic coronaviruses in water</p>	In general, coronaviruses have low stability in water and are inactivated relatively quickly in water. Survival is highly dependent on water temperature.	Low	Low

environments: Occurrence, persistence and concentration methods - A scoping review. <i>Water Research</i> 179:115899			environments from China, Saudi Arabia, USA (n = 2), and Kazakhstan No studies were found specific to COVID-19			
Usher Network for COVID-19 Evidence Reviews (2020, April 2). Review: What is the evidence for the importance of outdoor transmission and of indoor transmission of COVID-19?	Apr 2, 2020 (search to Mar 31, 2020)	Indoor, Outdoor	No studies found comparing transmission indoors vs. outdoors No studies found reporting transmission in outdoors.	There is no direct evidence to compare the likelihood of transmission of COVID-19 indoors vs. outdoors.	Moderate	N/A

References

- Brainard, JS., Jones, N., Lake, I., Hooper, L., Hunter, P. (2020). [Facemasks and similar barriers to prevent respiratory illness such as COVID-19: A rapid systematic review](#). *Preprint*.
- ECRI Institute (2020). [Cloth face coverings worn by public to reduce transmission of viral respiratory infection](#).
- Eikenberry, SE., Mancuso, M., Iboi, E., Phan, T., Eikenberry, K., Kuang, Y., Kostelich, E., Gumel, AB. (2020). [To mask or not to mask: Modeling the potential for face mask use by the general public to curtail the COVID-19 pandemic](#). *Infectious Disease Modelling*, 5:293-308
- Gupta, M., Gupta, K., Gupta, S (2020). [The use of facemasks by the general population to prevent transmission of COVID-19 infection: A systematic review](#). *Preprint*
- La Rosa, G., Bonadonna, L., Lucentini, L., Kenmoe, S., Suffredini, E. (2020). [Coronavirus in water environments: Occurrence, persistence and concentration methods - A scoping review](#). *Water Research* 179:115899
- Marasinghe, KM. (2020). [Concerns around public health recommendations on face mask use among individuals who are not medically diagnosed with COVID-19 supported by a systematic review search for evidence](#). *Preprint*.
- Oxford COVID-19 Evidence Service. (2020). [What forms of non-standard PPE are there \(e.g. home-made masks\) and what is the evidence of their efficacy?](#)
- Usher Network for COVID-19 Evidence Reviews. (2020). [Review: What is the evidence for the importance of outdoor transmission and of indoor transmission of COVID-19?](#)
- Usher Network for COVID-19 Evidence Reviews. (2020). [Review: What is the evidence for outdoor transmission of SARSCoV-2?](#)
- Usher Network for COVID-19 Evidence Reviews. (2020). [Summary: What is the effectiveness of face masks in preventing respiratory transmission in the community?](#)