COVID-19 INFORMATION

Non-medical masks

Non-medical masks to reduce community spread of COVID-19

1. Non-medical cloth masks offer protection to the public as source control in reducing dispersion of droplets from infected wearers. Evidence also suggests that non-medical masks can potentially reduce infective dose inhaled by wearers and reduce disease severity.
2. There is variability in the effectiveness of homemade and cloth masks. Layering of fabrics and ensuring a good fit are important.
3. There are theoretical risks of harm from mask use, including self-contamination, skin irritation, or personal discomfort. These risks may be mitigated by proper mask care/use and different fabric combinations. There is insufficient evidence to recommend which medical conditions may require mask exemptions.

Reasons for using non-medical masks

Reviews of observational studies suggest that the risk for infection is highly dependent on distance to the individual infected and the type of a mask. (Chu et al.) Wearing non-medical masks in public places, where physical distancing is difficult, is a public health risk mitigation measure to suppress the transmission of respiratory coronaviruses, such as SARS-CoV-2. The spectrum of infection with this virus can range from people with very mild, non-respiratory symptoms to severe acute respiratory illness, sepsis with organ dysfunction and death.

Non-medical masks can be used either for:

- Protection of healthy persons when in contact with infectious individuals. [Note that medical masks are preferred, in addition to other components of PPE, when interacting with an infected individual]; or
- For source control (worn by an infected individual to prevent onward transmission).

When an infected person and another person are both masked, the chance of a transmission decreases by 40-80%. Furthermore, even moderately efficacious masks will lower exposure viral load 10-fold among people who get infected despite masking, potentially limiting infection severity. (Goyal et al., Gandhi et al.) However, masking alone is insufficient to provide an adequate level of protection or source control. SARS-CoV-2, the virus responsible for COVID-19, is highly transmissible with the average number of new infections generated by an infectious person or (R_0) ranging from 1.95 to 3.28 people. (Liu et al.) Multiple personal and community level measures are needed to suppress transmission. In addition to masking, the most effective measures include practicing physical distancing and performing hand hygiene frequently.

Protection from Infected Individuals with or without Symptoms

Most transmission of COVID19 occurs from symptomatic people to others in close contact, when not wearing medical or non-medical masks. Individuals are most infectious during the initial days of infection or 48 to 72 hours before starting to experience symptoms. (Howard et al., WHO)

There is growing evidence that a significant portion of people who have COVID-19 do not show symptoms while infectious. These individuals can be:

- Asymptomatic (15-20% of infected individuals), meaning they are infected with COVID-19, but do not ever develop any symptoms; or
- Pre-symptomatic (6-12% of infected individuals), meaning they are infected, but have not developed symptoms. (Alberta Scientific Advisory Group Rapid Response Review)

Unlike observational studies, modelling studies estimate higher rates of transmission by individuals showing no symptoms. (Sifka et al.) It is still unclear to what extent individuals without symptoms spread the virus, with more research needed, however asymptomatic cases do contribute to transmission to some extent.

Protection from Droplet, Close Contact and Aerosol Modes of Transmission

The primary mode of transmission of COVID-19 is through direct contact from respiratory droplets. These have the potential to be propelled for varying distances, when an infected individual coughs, sneezes, talks or sings. (Burke et al., Chan et al., Pung et al., Anfinrud et al.) Individuals can also become infected after being in close contact with a case in a pre-symptomatic period, who is later confirmed to have COVID-19. (Huang R et al., Tong et al., Yu P et al.) Direct contact is defined as close contact within a two-metre distance for a prolonged period of time (i.e., 15-minute cumulative exposure). In these circumstances, infectious respiratory droplets can reach the mouth, nose or eyes of a susceptible person and can result in an infection.

In some specific circumstances, the virus can also be spread by the dissemination of aerosols that remain infectious when suspended in air over distances and time. (Public Health Agency of Canada) This can occur in healthcare settings during medical procedures that generate aerosols. (Tran et al., WHO). There is also evidence of aerosol transmission in crowded and inadequately ventilated indoor spaces when people spend a prolonged period of time around infected individuals. (Leclrec et al., Lu et al.,Jang et al.) Many experimental studies also suggest this route of transmission. (van Doremalen et al., Fears et al., Asadi et al., Mittal et al.) More research is needed given the possible implications of this transmission mode.

Taking into account the available studies evaluating pre- and asymptomatic transmission, a growing compendium of observational evidence on the use of masks by the general public in several countries, as well as the difficulty of physical distancing in many contexts, WHO encourages the general public to wear masks as part of a comprehensive approach to suppress SARS-CoV-2 transmission.

Impact on Community Transmission

No randomized controlled trials have been completed to evaluate the effectiveness of mask use for COVID-19. However, there is a trial in Denmark underway (NCT04337541). In the past, masks have been deemed effective in studies on suppressing transmission of other respiratory viruses. (Jefferson et al., Suess et al.,Cowling et al., Stockwell et al., Dharmadhikari et al.)

More observational COVID-19 studies are emerging on masking impact. A cluster study from China reports lower pre-symptomatic transmission rate from mask-wearing cases (8.1%) compared to non-mask-wearing cases (19.0%). (Hong et al.) In the United States, a contact investigation of two COVID-19-positive hairstylists with respiratory symptoms, who wore cloth masks during close contact with 139 clients also wearing face masks, reported no secondary transmissions. (Hendrix et al.) Population-based studies also support protective/ source control effects from the wide-spread mask use. Mandatory masking in Jena, Germany, reduced the daily growth rate of COVID-19 by 40% in comparison to other German cities without masking orders. (Mitze et al.) A study from Beijing, China, notes that when masks were worn prior to the development of symptoms, there was a 79% reduction in transmission. (Wang et al.) Modelling studies of mask mandates in health regions in Ontario also present a reduction of 25% in the weekly number of new COVID-19 cases. Counterfactual policy simulations suggest that mandating indoor masks nationwide in early July could have reduced the weekly number of new cases in Canada by 25 to 40% in mid-August, which translates into 700 to 1,100 fewer cases per week. (Karaivanov et al.) Examples of settings where medical or non-medical masks should be used are available in the WHO reports.

Population-based modelling studies show a decrease in new COVID-19 cases in regions where mandatory public mask policies have been implemented compared to regions where such policies were delayed. (Public Health Ontario Review). Studies show that the average daily growth rate of confirmed positives is 18% in countries with no pre-existing mask norms and 10% in countries with such norms; the growth rate of deaths is 21% in countries with no mask norms and 11% in countries with such norms. (Abaluck et al.) By January 2021, if current trends continue, modelling estimates that the total number of deaths will reach 2.5 million, a figure that could be cut to 1.8 million if every country adopts universal mask-wearing. (University of Washington's Institute for Health Metrics and Evaluation)

Overall, the available evidence suggests that near-universal adoption of non-medical masks in all indoor public places, in combination with complementary public health measures, could successfully reduce R_0 to below 1.0, thereby stopping community spread. Economic analysis suggests that the impact of mask wearing could be thousands of dollars saved per person per mask in healthcare costs associated with COVID-19. (Abaluck et al.) However, experts are aware that there may be confounding by other bundled public health measures, such as physical distancing and hand-washing. (Alberta Scientific Advisory Group Rapid Response Review)

Importance of fabric selection and fit in cloth mask construction

The extent to which cloth masks can protect individuals from being infected needs further study. Several studies compared common household fabrics at blocking high-velocity droplets, using a commercial medical mask as a benchmark. The body of evidence supports that certain fabrics provide sufficient filtration to be a suitable option for source control in non-healthcare settings. The Public Health Agency of Canada recommends three layer masks made of tightly woven materials. The following studies represent this growing body of evidence.

Face shields are not a replacement for non-medical masks.

Recommended Fabrics

Ho et al. compared a 3-layer 100% cotton mask versus surgical masks and found 86.4% and 99.9% filtration efficiency, respectively. Both surgical and cotton masks significantly reduced filtered particles, compared to no mask, with no significant differences between mask types.

Konda et al. evaluated filtration efficiency for different particle sizes and 15 cloth types (e.g. cotton, silk, flannel, etc.). These were evaluated in different configurations (e.g.

layers, combinations, and with simulated "gaps" in seal as may be expected in real-world use), and compared to N95 and surgical masks, using an aerosol generator. The study observed that fabric with tight weaves and low porosity or combinations of materials (e.g. high threads-per-inch cotton along with silk, chiffon, or flannel) filtered particles across the tested size spectrum at 80% efficiency.

Lustig et al. evaluated filtration efficiency using simulated cough/sneeze-generated aerosols, testing over 70 different common fabric combinations. Combinations of materials with hydrophilic (moisture wicking), hydrophobic (moisture repellent), and absorbent layers were most efficient, and were comparable to materials in N95 respirators in this laboratory setting. Examples of effective absorbent layers are terry cloth towel, quilting cotton, and flannel. Examples of effective barrier layers are unwoven polypropylene, polyester, and polyaramid layered fabric.

Aydin et al. evaluated the performance of 11 common household fabrics at blocking large, high-velocity droplets, using a commercial medical mask as a benchmark. It also assessed the breathability (air permeability), texture, fiber composition, and water absorption properties of the fabrics. The study found that most fabrics have substantial blocking efficiency at or over 70%. In particular, two layers of highly permeable fabric, such as T-shirt cloth, blocks droplets with an efficiency of over 94%, similar to that of medical masks, while being approximately twice as breathable. The study concluded that cloth face coverings, especially with multiple layers, may help reduce droplet transmission of respiratory infections.

Overall, the Public Health Agency of Canada is now recommending Canadians choose three-layer non-medical masks with a filter layer to prevent the spread of COVID-19. The Public Health Agency along with Alberta Scientific Advisory Group Rapid Response Review and WHO recommend an optimal combination of materials for non-medical masks should include three layers:

- An innermost layer of a hydrophilic material (e.g. cotton or cotton blends);
- An outermost layer made of hydrophobic material (e.g., polypropylene, polyester, or their blends); and
- A middle hydrophobic layer of synthetic non-woven material such as polypropylene, or a cotton layer, which may enhance filtration or retain droplets.

It is preferable not to select elastic material for making masks; during wear, the mask material may be stretched over the face, resulting in increased pore size and lower filtration efficiency throughout use. Elastic materials may also degrade over time and are sensitive to washing at high temperatures. (WHO)

Importance of Fit

Optimally constructed cloth/ home-made masks can offer protection in reducing dispersion of droplets. However, droplet leakage through gaps can significantly reduce mask effectiveness. Gaps (as caused by an improper fit of the mask) can result in over a 60% decrease in the filtration efficiency. (Konda et al.) Cloth masks could be made more effective by ensuring proper sealing against the face contour. For example, a recent study reported that adding a layer of nylon stocking over the masks minimized the airflow around the edges of the masks and improved particle filtration efficiency for both home-made and commercial masks. (Mueller et al.)

To be effective, masks have to be worn and maintained properly. Please check these resources for advice.

- World Health Organization
- Health Canada
- Public Health Agency of Canada
- Alberta Health Services
- National Collaborating Centre for Environmental Health (Canada)
- Centres for Disease Control and Prevention (USA) (CDC)

Potential harm

This evidence review stresses that mask wearing can reduce potential exposure risk from infected persons before they develop symptoms and protect healthy individuals. The likely disadvantages of the use of non-medical masks by healthy people in public include theoretical risks of self-contamination, increased risky behaviour, and negative personal impacts.

Self-Contamination

- Evidence is not conclusive about potential increased risk of self-contamination due to the manipulation of a face mask and subsequent eye/nose/mouth touching with contaminated hands. Some non-COVID 19 research suggests this as an issue (Zamora, et al), while more recent work found a decrease in face-touching behaviour while masking. (Chen, et al.)
- Potential self-contamination that can occur if nonmedical masks are not changed when wet or soiled.
- Poor compliance with proper mask wearing, in particular by young children.

Increased Risky Behaviour

- A theoretical risk of a false sense of security, leading to potentially lower adherence to other critical preventive measures such as physical distancing and hand hygiene.
- Increased mobility and time spent away from home. (Kovacs et al)

Negative Personal Impacts

- Potential headache and/or breathing difficulties, depending on type of mask used.
- Potential development of facial skin lesions, irritant dermatitis or worsening acne, when masked frequently for long hours.
- Difficulty with communicating clearly; particularly, difficulty communicating for deaf or hearing impaired persons who rely on lip reading.
- Disadvantages or difficulty wearing masks, especially for children, developmentally challenged persons, those with mental illness, elderly persons with cognitive impairment, those with asthma or chronic respiratory or breathing problems, those who have had facial trauma or recent oral maxillofacial surgery, and those living in hot and humid environments.

Adaptations and alternatives should be considered whenever possible to increase the feasibility of wearing a mask or to reduce the risk of COVID-19 spreading, if it is not possible to wear one. CDC maintains a list of useful adaptations.

At this time, there is insufficient evidence to recommend mask exemptions for specific populations based on their medical conditions. However, individuals that are unable to wear a mask should avoid all circumstances where they are unable to appropriately physical distance from others. (Alberta Scientific Advisory Group Rapid Response Review)

Go to alberta.ca/covid19 for the most up-to-date information on restrictions to contain COVID-19.

References

Abaluck, J., Chevalier, J. A., Christakis, N. A., Forman, H. P., Kaplan, E. H., Ko, A., & Vermund, S. H. (2020). The case for universal cloth mask adoption and policies to increase supply of medical masks for health workers. *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.3567438

Alberta Health Services. (2020). *Evidence of harm from mask use for specific populations*. https://www.albertahealthservices.ca/assets/info/ppih/if-ppih-covid-19-sag-evidence-of-harm-from-mask-use-for-specific-populations.pdf

Alberta Health Services. (2020). *What is the effectiveness of wearing medical masks, including home-made masks, to reduce the spread of COVID-19 in the community?*. https://www.albertahealthservices.ca/assets/info/ppih/if-ppih-covid-19-sag-mask-use-in-community-rapid-review.pdf

Alberta Health Services. (2020). *What is the evidence supporting the possibility of asymptomatic transmission of SARS-CoV-2?.* https://www.albertahealthservices.ca/assets/info/ppih/if-ppih-covid-19-sag-asymptomatic-transmission-rapid-review.pdf

Alberta Health Services. (2020). *What role might children play in community SARS-CoV-2 transmission? What measures might mitigate potential additional risk of transmission of COVID-19 related to school and daycare reopening?*. https://www.albertahealthservices.ca/assets/info/ppih/if-ppih-covid-19-sag-role-of-children-in-community-transmission-rapid-review.pdf

Alberta Health Services. (2020, September 23). *Novel coronavirus (COVID-19) information for Albertans*. https://www.albertahealthservices.ca/topics/page16997.aspx

Anfinrud, P., Stadnytskyi, V., Bax, C. E., & Bax, A. (2020). Visualizing speech-generated oral fluid droplets with laser light scattering. *New England Journal of Medicine*, *382*(21), 2061–2063. https://doi.org/10.1056/nejmc2007800

Asadi, S., Bouvier, N., Wexler, A. S., & Ristenpart, W. D. (2020). The coronavirus pandemic and aerosols: Does COVID-19 transmit via expiratory particles? *Aerosol Science and Technology*, *54*(6), 635–638. https://doi.org/10.1080/02786826.2020.1749229

Aydin, O., Emon, B., Cheng, S., Hong, L., Chamorro, L. P., c Saif, M. T. A. (2020). Performance of fabrics for home-made masks against the spread of COVID-19 through droplets: A quantitative mechanistic study. *Extreme Mechanics Letters*, *40*, 100924. https://doi.org/10.1016/j.eml.2020.100924

Bourouiba, Lydia. (2020). Turbulent gas clouds and respiratory pathogen emissions: Potential implications for reducing transmission of COVID-19." *JAMA*. https://doi.org/10.1001/jama.2020.4756

Buitrago-Garcia, D., Egli-Gany, D., Counotte, M. J., Hossmann, S., Imeri, H., Ipekci, A. M., … Low, N. (2020). Occurrence and transmission potential of asymptomatic and presymptomatic SARS-CoV-2 infections: A living systematic review and meta-analysis. *PLOS Medicine*, *17*(9). https://doi.org/10.1371/journal.pmed.1003346

Burke, R. M., Midgley, C. M., Dratch, A., Fenstersheib, M., Haupt, T., Holshue, M., … Rolfes, M. A. (2020). Active monitoring of persons exposed to patients with confirmed COVID-19 — United States, January–February 2020. *MMWR. Morbidity and Mortality Weekly Report*, *69*(9), 245–246. https://doi.org/10.15585/mmwr.mm6909e1

Centers for Disease Control and Prevention. (2020, August 7). *How to Select, Wear, and Clean Your Mask*. https://www.cdc.gov/coronavirus/2019-ncov/prevent-getting-sick/about-face-coverings.html

Centers for Disease Control and Prevention. (2020, August 7). *Considerations for Wearing Masks Help Slow the Spread of COVID-19*. https://www.cdc.gov/coronavirus/2019-ncov/prevent-getting-sick/cloth-face-cover-guidance.html

Chan, J. F.-W., Yuan, S., Kok, K.-H., To, K. K.-W., Chu, H., Yang, J., … Yuen, K.-Y. (2020). A familial cluster of pneumonia associated with the 2019 novel coronavirus indicating person-to-person transmission: a study of a family cluster. *The Lancet*, *395*(10223), 514–523. https://doi.org/10.1016/s0140-6736(20)30154-9

Chen Yong, Gang Qin, Chen Jie (2020) Comparison of Face-Touching Behaviors Before and During the Coronavirus Disease 2019 Pandemic. *JAMA* 3(7):e2016924. doi:10.1001/jamanetworkopen.2020.16924 https://jamanetwork.com/journals/jamanetworkopen/fullarticle/2768767

Chu, D. K., Akl, E. A., Duda, S., Solo, K., Yaacoub, S., & Schünemann, H. J. (2020). Physical distancing, face masks, and eye protection to prevent person-to-person transmission of SARS-CoV-2 and COVID-19: a systematic review and meta-analysis. *The Lancet*, *395*(10242), 1973–1987. https://doi.org/10.1016/s0140-6736(20)31142-9

Cowling, B. J., Chan, K.-H., Fang, V. J., Cheng, C. K., Fung, R. O., Wai, W., … Leung, G. M. (2009). Facemasks and hand hygiene to prevent influenza transmission in households. *Annals of Internal Medicine*, *151*(7), 437. https://doi.org/10.7326/0003-4819-151-7-200910060-00142

Dharmadhikari, A. S., Mphahlele, M., Stoltz, A., Venter, K., Mathebula, R., Masotla, T., … Nardell, E. A. (2012). Surgical face masks worn by patients with multidrug-resistant tuberculosis. *American Journal of Respiratory and Critical Care Medicine*, *185*(10), 1104–1109. https://doi.org/10.1164/rccm.201107-1190oc

Doremalen, N. V., Bushmaker, T., Morris, D. H., Holbrook, M. G., Gamble, A., Williamson, B. N., … Munster, V. J. (2020). Aerosol and surface stability of SARS-CoV-2 as compared with SARS-CoV-1. *New England Journal of Medicine*, *382*(16), 1564–1567. https://doi.org/10.1056/nejmc2004973

Fears, A. C., Klimstra, W. B., Duprex, P., Hartman, A., Weaver, S. C., Plante, K. S., … Roy, C. J. (2020). Persistence of severe acute respiratory syndrome coronavirus 2 in aerosol suspensions. *Emerging Infectious Diseases*, *26*(9), 2168–2171. https://doi.org/10.3201/eid2609.201806

Government of Canada. (2020, July 16). *Non-medical masks and face coverings: How to put on, remove and clean*. https://www.canada.ca/en/public-health/services/diseases/2019-novel-coronavirus-infection/prevention-risks/how-put-remove-clean-non-medical-masks-face-coverings.html

Ho, K.-F., Lin, L.-Y., Weng, S.-P., & Chuang, K.-J. (2020). Medical mask versus cotton mask for preventing respiratory droplet transmission in micro environments. *Science of The Total Environment*, *735*, 139510. https://doi.org/10.1016/j.scitotenv.2020.139510

Hong, L.-X., Lin, A., He, Z.-B., Zhao, H.-H., Zhang, J.-G., Zhang, C., … Yan, W.-H. (2020). Mask wearing in pre-symptomatic patients prevents SARS-CoV-2 transmission: An epidemiological analysis. *Travel Medicine and Infectious Disease*, *36*, 101803. https://doi.org/10.1016/j.tmaid.2020.101803

Howard, J., Huang, A., Li, Z., Tufekci, Z., Zdimal, V., Westhuizen, H.M. V. D., … Rimoin, A. W. (2020). Face masks against COVID-19: An evidence review. https://doi.org/10.20944/preprints202004.0203.v1

Huang, R., Xia, J., Chen, Y., Shan, C., & Wu, C. (2020). A family cluster of SARS-CoV-2 infection involving 11 patients in Nanjing, China. *The Lancet Infectious Diseases*, *20*(5), 534–535. https://doi.org/10.1016/s1473-3099(20)30147-x

Jang, S., Han, S. H., & Rhee, J.-Y. (2020). Cluster of coronavirus disease associated with fitness dance classes, South Korea. *Emerging Infectious Diseases*, *26*(8), 1917–1920. https://doi.org/10.3201/eid2608.200633

Jefferson, T., Mar, C. B. D., Dooley, L., Ferroni, E., Al-Ansary, L. A., Bawazeer, G. A., … Conly, J. M. (2011). Physical interventions to interrupt or reduce the spread of respiratory viruses. *Cochrane Database of Systematic Reviews*. https://doi.org/10.1002/14651858.cd006207.pub4

Konda, A., Prakash, A., Moss, G. A., Schmoldt, M., Grant, G. D., & Guha, S. (2020). Aerosol filtration efficiency of common fabrics used in respiratory cloth masks. *ACS Nano*, *14*(5), 6339–6347. https://doi.org/10.1021/acsnano.0c03252

Kovacs, R., Dunaiski, M., & Tukiainen, J. (2020). Compulsory face mask policies do not affect community mobility in Germany. *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.3620070

Leclerc, Q. J., Fuller, N. M., Knight, L. E., Funk, S., & Knight, G. M. (2020). What settings have been linked to SARS-CoV-2 transmission clusters? *Wellcome Open Research*, *5*, 83. https://doi.org/10.12688/wellcomeopenres.15889.2

Liu, Y., Gayle, A. A., Wilder-Smith, A., & Rocklöv, J. (2020). The reproductive number of COVID-19 is higher compared to SARS coronavirus. *Journal of Travel Medicine*, *27*(2). https://doi.org/10.1093/jtm/taaa021

Lu, J., Gu, J., Li, K., Xu, C., Su, W., Lai, Z., … Yang, Z. (2020). COVID-19 outbreak associated with air conditioning in restaurant, Guangzhou, China, 2020. *Emerging Infectious Diseases*, *26*(7), 1628–1631. https://doi.org/10.3201/eid2607.200764

Lustig, S. R., Biswakarma, J. J. H., Rana, D., Tilford, S. H., Hu, W., Su, M., & Rosenblatt, M. S. (2020). Effectiveness of common fabrics to block aqueous aerosols of virus-like nanoparticles. *ACS Nano*, *14*(6), 7651–7658. https://doi.org/10.1021/acsnano.0c03972

Mittal, R., Ni, R., & Seo, J. H. (2020). The flow physics of COVID-19. *Journal of Fluid Mechanics*, *894*. https://doi.org/10.1017/jfm.2020.330

Mitze, T., Kosfeld, R., Rode, J., & Wälde, K. (2020). *Face masks considerably reduce COVID-19 cases in Germany: A synthetic control method approach*. (IZA Discussion Paper Series No. 133190). https://www.iza.org/publications/dp/13319/face-masks-considerably-reduce-covid-19-cases-in-germany-a-synthetic-control-method-approach

Mueller, A. V., Eden, M. J., Oakes, J. M., Bellini, C., & Fernandez, L. A. (2020). Quantitative method for comparative assessment of particle removal efficiency of fabric masks as alternatives to standard surgical masks for PPE. *Matter*, *3*(3), 950–962. https://doi.org/10.1016/j.matt.2020.07.006

National Library of Medicine (U.S.). (2020, April -). *Reduction in COVID-19 infection using surgical facial masks outside the healthcare system*. Identifier NCT04337541. https://clinicaltrials.gov/ct2/show/NCT04337541

Public Health Ontario. (2020). *Wearing masks in public and COVID-19 – what we know so far*. https://www.publichealthontario.ca/-/media/documents/ncov/covid-wwksf/what-we-know-public-masks-apr-7-2020.pdf?la=en

Pung, R., Chiew, C. J., Young, B. E., Chin, S., Chen, M. I.-C., Clapham, H. E., … Ang, L. W. (2020). Investigation of three clusters of COVID-19 in Singapore: implications for surveillance and response measures. *The Lancet*, *395*(10229), 1039–1046. https://doi.org/10.1016/s0140-6736(20)30528-6

Slifka, M. K., & Gao, L. (2020). Is presymptomatic spread a major contributor to COVID-19 transmission? *Nature Medicine*. https://doi.org/10.1038/s41591-020-1046-6

Suess, T., Remschmidt, C., Schink, S. B., Schweiger, B., Nitsche, A., Schroeder, K., … Buchholz, U. (2012). The role of facemasks and hand hygiene in the prevention of influenza transmission in households: results from a cluster randomised trial; Berlin, Germany, 2009-2011. *BMC Infectious Diseases*, *12*(1). https://doi.org/10.1186/1471-2334-12-26

Stockwell, R. E., Wood, M. E., He, C., Sherrard, L. J., Ballard, E. L., Kidd, T. J., … Sly, P. D. (2018). Face masks reduce the release of pseudomonas aeruginosa cough aerosols when worn for clinically relevant periods. *American Journal of Respiratory and Critical Care Medicine*, *198*(10), 1339–1342. https://doi.org/10.1164/rccm.201805-0823le

Tong, Z.-D., Tang, A., Li, K.-F., Li, P., Wang, H.-L., Yi, J.-P., … Yan, J.-B. (2020). Potential presymptomatic transmission of SARS-CoV-2, Zhejiang Province, China, 2020. *Emerging Infectious Diseases*, *26*(5), 1052–1054. https://doi.org/10.3201/eid2605.200198

Tran, K., Cimon, K., Severn, M., Pessoa-Silva, C. L., & Conly, J. (2011). Aerosol-generating procedures and risk of transmission of acute respiratory infections: a systematic review. *CADTH Technology Overviews*, *3*(1). https://www.cadth.ca/media/pdf/M0023__Aerosol_Generating_Procedures_e.pdf

Wang, Y., Tian, H., Zhang, L., Zhang, M., Guo, D., Wu, W., … Macintyre, C. R. (2020). Reduction of secondary transmission of SARS-CoV-2 in households by face mask use, disinfection and social distancing: a cohort study in Beijing, China. *BMJ Global Health*, *5*(5). https://doi.org/10.1136/bmjgh-2020-002794

Worby, C. J., & Chang, H. H. (2020). Face mask use in the general population and optimal resource allocation during the COVID-19 pandemic. *Nature Communications, 11*(1). https://www.nature.com/articles/s41467-020-17922-x

World Health Organization. (2020, June 5). *Advice on the use of masks in the context of COVID-19: interim guidance*. https://apps.who.int/iris/handle/10665/332293

World Health Organization. (2020, June 7). *Criteria for releasing COVID-19 patients from isolation: scientific brief*. https://www.who.int/news-room/commentaries/detail/criteria-for-releasing-covid-19-patients-from-isolation

World Health Organization. (2020, July 9). *Transmission of SARS-CoV-2: implications for infection prevention precautions*. https://www.who.int/news-room/commentaries/detail/transmission-of-sars-cov-2-implications-for-infection-prevention-precautions

World Health Organization. (2014). *Infection prevention and control of epidemic-and pandemic-prone acute respiratory infections in health care*. https://apps.who.int/iris/bitstream/handle/10665/112656/9789241507134_eng.pdf;jsessionid=41AA684FB64571CE8D8A453C4F2B2096?sequence=1

Yu, P., Zhu, J., Zhang, Z., & Han, Y. (2020). A familial cluster of infection associated with the 2019 novel coronavirus indicating possible person-to-person transmission during the incubation period. *The Journal of Infectious Diseases*, *221*(11), 1757–1761. https://doi.org/10.1093/infdis/jiaa077

Zamora, J. E. (2006). Contamination: a comparison of 2 personal protective systems. *Canadian Medical Association Journal*, *175*(3), 249–254. https://doi.org/10.1503/cmaj.060094