



INTERNATIONAL  
SOCIETY  
FOR INFECTIOUS  
DISEASES

# GUIDE TO INFECTION CONTROL IN THE HEALTHCARE SETTING

## The Importance of Non- pharmacologic Interventions for the Prevention of COVID-19 Transmission

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## ABSTRACT

COVID-19 has swept the globe since late 2019, with over 10.5 million cases and greater than 500,000 deaths on July 1, 2020. There are powerful non-pharmacologic interventions for interrupting the transmission of SARS-CoV-2. Social distancing and robust contact tracing with quarantine have been linked to control in several countries: the earlier the strict implementation, the lower the peak and the earlier the flattening of the epidemiologic curve of cumulative cases. Hand washing and isolation remain the pillars of infection prevention. Appropriate environmental cleaning and personal protective equipment also help prevent spread.

## KEY ISSUES

Classic public health interventions, such as isolation, quarantine and social distancing are critical ways to address this pandemic. Other non-pharmaceutical interventions such as hand hygiene, masking, and environmental cleaning will assist in limiting spread of viral particles. While much is unknown about SARS-CoV-2 and some of the non-pharmaceutical interventions have low quality evidence, it is still prudent to apply the theoretical benefits from these interventions

## KNOWN FACTS

- SARS-CoV-2 remains viable in aerosols and large respiratory droplets, the source of most transmission. A vast majority of transmission occur indoors, rather than outside. Multiple super-spreading events have been noted during the pandemic.

- The incubation period of SARS-CoV-2 based on familiar clusters is 3-6 days. The mean incubation period is 6.4 days, ranging from 2.1 to 11.1 days.
- SARS-CoV-2 has been detected in bronchoalveolar lavage fluid, sputum, and nasal swabs at high levels. It has also been detected at lower levels in fibrobronchoscope brush biopsy, pharyngeal swabs, feces, blood, and urine.
- Presymptomatic and asymptomatic infections are of significant concern. Such undocumented infections were the source of 79% of documented cases in China prior to the implementation of travel restrictions and other heightened infection control measures on 23 January 2020.
- Human coronaviruses, including Severe Acute Respiratory Syndrome (SARS-CoV-1), Middle East Respiratory Syndrome (MERS) and the less virulent endemic human coronaviruses (eg HCoV-229E) can persist on inanimate surfaces like metal, glass or plastic for up to 9 days. It is presumed SARS-CoV-2 will have a similar profile.
- It is stable on plastic and stainless steel up to 72 hours after application. No viable SARS-CoV-2 remains on copper after 4 hours, and none on cardboard after 24 hours. Aerosol and fomite transmission remain plausible, depending on inoculum.
- Coronaviridae can be inactivated by surface disinfection procedures with 62-71% ethanol, 0.5% hydrogen peroxide or 0.1% sodium hypochlorite within 1 minute. Other biocidal agents such as 0.05-0.2% benzalkonium chloride or 0.02% chlorhexidine digluconate are less effective.
- Self-inoculation from the contaminated hands to the face is of concern. In an analysis of student behavior, it was noted they touch their face with their own hands on average 23 times per hour, with contact mostly to the skin (56%), followed by the mouth (36%), nose (31%), and eyes (31%).

- Social distancing reduces interactions between members of a community, reducing proximity between people who may or may not be infected and interrupting transmission. This includes closures of schools or office, cancellation of mass gatherings, and suspension of public markets. Community wide containment is a continuum from social distancing to community-wide quarantine with major movement restrictions of everyone. These measures are ethically challenging with individual human rights weighed against the public health imperative. Implementation requires close partnerships and cooperation, as well as potential legal penalties if violations occur.
- The preliminary reproductive number ( $R_0$ ) was estimated by the WHO as 1.4-2.5, however more recent estimates suggest 2.24-3.58, and based on predicted infected cases, 3.2-3.9. This is anticipated to change as more is learned.
- Unprecedented lockdowns of all but essential personnel occurred across Europe and had a large effect on reducing SARS-CoV-2 transmission. The initial  $R_0$  was around 3.8 (2.4-5.6), but with non-pharmaceutical interventions, this dropped to 0.44 (Norway)-0.82 (Belgium), averaging around 0.66 across 11 countries, an 82% reduction compared to pre-intervention values. Due to implementation of lockdown and other interventions such as closing schools, banning public events, encouragement of social distancing, and case-based isolation at similar times, the model could not determine which intervention was most successful. Some current models suggest that staying at home and closing entertainment venues were the most effective components of social distancing.
- Only lockdown periods were sufficient to bring  $R_0$  under 1, though school closure, physical distancing, shielding >70-year-olds, and self-isolation of symptomatic cases each reduces  $R_0$ .
- A systematic review and meta-analysis of 172 observational studies across 16 countries and 6 continents reviewed effects of physical distance, face masks, and eye protection.

- Transmission of virus is lower with physical distancing  $\geq 1\text{m}$  (aOR 0.18, 95% CI 0.09-0.38, risk difference -10.2, 95% CI -11.5 to -7.5). Protection was noted to increase with lengthening of distances (change in relative risk 2.02 per meter,  $p=0.041$ ).
- Face mask use reduces risk of infection (aOR 0.15, 95% CI 0.07-0.34) with stronger association with N95 or similar respirators compared to disposable surgical (droplet) masks.
- Eye protection was also associated with less infection (aOR 0.22, 95% CI 0.12-0.39).
- More research is needed into transfer of viable virus from the respiratory mucosa onto hands and other surfaces, the survival of virus on these surfaces, and inoculation of another person's respiratory mucosa.
- The impact of temperature and humidity must also be researched. UV light is known to be virucidal.
  - A multivariate linear regression model including population density, geographical location, and global horizontal solar irradiance explained 70% (via  $R^2$ ) of the variance in the differences in the incidence of COVID-19. Population density ( $p=0.019$ ) and global horizontal solar irradiance ( $p=0.027$ ) were independent predictors of the cumulative incidence of COVID-19.
  - The incidence of COVID-19 declines with increasing temperatures  $>52^\circ\text{F}$  ( $11^\circ\text{C}$ ), as well as higher UV index, but precipitation was not associated with a great rate of cases. The associations are small.

## SUGGESTED PRACTICE

- Strict contact tracing with robust quarantine are effective early in a pandemic or when the rates are low. When the rates of infection are higher, social lockdowns are necessary as effective interventions were likely delayed.
- Lockdown periods will likely be needed for large proportions of the upcoming year to prevent health-care demand exceeding availability.
- We must use classical public health measures to curb this respiratory viral epidemic:
  - Isolation separates the ill from the non-infected to protect the non-infected; it interrupts transmission.
  - Quarantine restricts the movement of those presumed to be exposed; it can be applied to an individual or group and may be voluntary or mandatory.
  - Isolation and quarantine remain valid interventions.
  - Physical distancing (social distancing) is a crucial step. >1-meter distance should be maintained as possible.
- Hand washing remains the cornerstone of infection prevention:
  - Frequent and appropriate hand washing is encouraged and should be reinforced.
  - Soap and water or an alcohol-based hand rub is appropriate.
  - All healthcare facilities should establish or strengthen pre-existing hand hygiene programs.
- Many countries recommend wearing of cloth masks to their citizens. The effectiveness of mask wearing by a large proportion of citizens during a pandemic is unknown (no randomized clinical controlled trial, which would be unethical), however, it is potentially harmful to dismiss a low-cost intervention because of no evidence of effectiveness. Mask use within a population needs to clearly communicate where, when, how and what type of mask should be worn; non-medical professionals lack familiarity with mask wearing and will need instruction in these details.

- Mask use must be considered in light of purpose (prevention or source control), exposure risk, vulnerability (mask wearer and population), setting, feasibility, and type of mask (medical, cloth).
- Cloth masks can be manufactured, or made at home; importantly, they can be reused.
- The public can be informed about wearing, as well as appropriate donning and doffing.
- Controlling harms at the source of potential infection via masks is at least as important as mitigation of infection through handwashing.
- There is potential for significant population benefits with mass masking. While stronger associations exist with respirators, there is benefit from droplet masks and cloth masks.
- The measure of masking shifts the focus from self-protection to altruism, actively involves every citizen, and is a symbol of social solidarity in the global response to the pandemic.
- Benefits or advantages to masking include reducing potential exposure risk, reduced stigmatization of those wearing masks, making people feel like they can contribute to stopping the spread, reminding people to be compliant with other measures, social and economic benefits like individual enterprise in making cloth masks.
  - In times of social unrest globally and crowded street demonstrations, the wearing of masks is likely to limit transmission somewhat and is strongly recommended.
- Harms of masks include self-contamination, dermatitis, discomfort, false sense of security. Masks may be difficult to wear by those with certain disabilities.
- Face shield are also a viable option to help prevent community transmission when physical distancing and stay-at-home measures are relaxed or not possible. Face shields are



comfortable, easy to wear, protect the portals of viral entry, limit autoinoculation, and allow visibility of facial expressions and lip movements for improved perception of speech.

- Medical masks remain preferred over non-medical masks, particularly in health care settings. Appropriately fitted respirators are preferred, however may not be accessible even in health care settings.
- Expert opinion and medical personnel's values recommend adopting continuous use of masks in high risk transmission areas (triage, family physician/GP practices, outpatient departments, emergency rooms, COVID-19 specific units, haematological cancer or transplant units, long term health units, and residential facilities).
- A non-medical mask standard has been developed by the French Standardization Association (AFNOR group) to define minimum performance in terms of filtration (70% solid particle filtration or droplet filtration) and breathability. These standards indicate that non-medical masks should only be considered for source control in community settings and not for prevention. In making decisions regarding non-medical masks, there should be multiple considerations: type of materials (filtration efficiency, breathability, filter quality), number of layers, combination of materials, mask shape, coating of fabric, and mask maintenance.
- We found that SARS-CoV-2 was efficiently inactivated by WHO-recommended formulations, supporting their use in healthcare systems and viral outbreaks.
  - Of note, both the original and modified formulations were able to reduce viral titers to background level within 30 s.
  - In addition, ethanol and 2-propanol were efficient in inactivating the virus in 30 s at a concentration of  $\geq 30\%$  (vol/vol).

- Alcohol constitutes the basis for many hand rubs routinely used in healthcare settings.
- Drying times must be considered, as many people do not fully allow the hand rub to dry before moving on to another task.
- Biowaste materials and sewage must be appropriately and adequately disinfected, treated, and disposed of properly.

## SUGGESTED PRACTICE IN UNDER-RESOURCED SETTINGS:

- All persons should avoid groups of people, maintain physical distance of at least 1-2 meters, perform hand hygiene frequently, use respiratory hygiene, and refrain from touching their mouth, nose, and eyes.
- Universal access to hand hygiene facilities should be provided in front of all public buildings and transport hubs—markets, shops, places of worship, schools, train or bus stations. Number or size of hand hygiene station should be adapted to the number and type of users, such as children or limited mobility. The installation, supervision and maintenance of equipment, regular refilling of water and soap and/or alcohol-based hand rub should be under the leadership of the public health authorities.
- Medical personnel should be provided with appropriate personal protective equipment (PPE) based on area of practice and level of exposure. Fabric/cloth masks may be appropriate to provide to other community members, as possible.
- Masks should be strongly considered when people are unable to be physically distant.
- Existing WHO standards should be followed for disposal of medical waste as well as faecal material.
  - Reinforcement of WASH standards remain critical in all areas with lack of appropriate sanitation standards.

- Contact tracing with quarantine is critical to prevent spread.

## SUMMARY

Traditional infection prevention practices like hand washing and respiratory etiquette are appropriate to help interrupt the transmission of SARS-CoV-2. Physical distancing, isolation, and quarantine remain viable solutions as well, though with ethical implications if the regulations are not mandatory. Lockdown is also an incredibly powerful tool for public health, however has significant complex implications outside the scope of public health. Masking, with medical grade respirators, droplet/surgical masks, and cloth masks remain essential aspects of mitigation of spread of SARS-CoV-2. Sanitation with water and waste material remains critically important. There are ongoing controversies and research into aerosolized vs large droplet transmission and the roles of asymptomatic or presymptomatic transmission. There is intense discussion about how long the pandemic will last and whether SARS-CoV-2 will become endemic. There are multiple vaccine and medication trials. While this landscape shifts rapidly, non-pharmaceutical interventions are relatively simple interventions to keep people safe and break the cycle of transmission.

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