

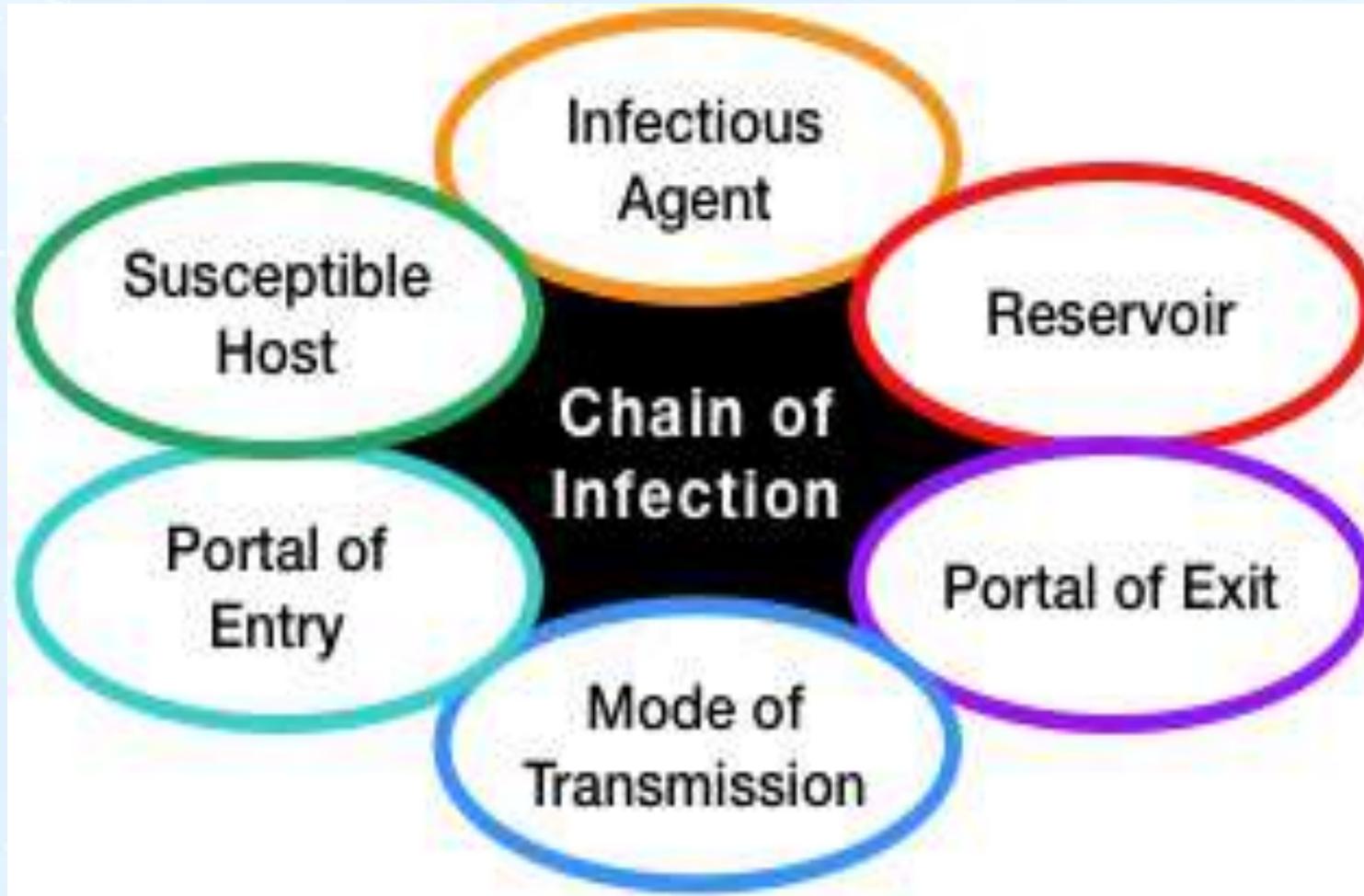
# Airborne Transmission of SARS-CoV-2: What is the Evidence?

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# Chain of Infection – Vital to Infection Prevention and Control



<https://www.atrainceu.com/content/1-examining-chain>

# Modes of Disease Transmission

- **Direct contact** with infected secretions, excretions, blood and fluids  
bloodborne pathogens – HIV, HBV, HCV (and direct contact with SARS-CoV2)
- **Indirect contact** with contaminated items patient and the environment  
MRSA, VRE, CRE, C.difficile (and indirect contact with surfaces with SARS-CoV2)
- **Droplet nuclei** (Influenza, Coronaviruses, Pertussis, Bacterial Meningitis, SARS-CoV-1, MERS-CoV) (most common spread of SARS-CoV2)
- **Airborne route** (TB, Chickenpox, Measles, ?SARS-CoV-2)  
suspended in air for extended period of time in small aerosols
- **Vector borne** (West Nile Virus, Equine Encephalitis, Malaria, Ebola Virus)

# Natural History of COVID-19

- Person infectious 48 hours before symptom onset
- Hospitalization may be in later stages of the disease
- Interesting - no hospital outbreaks of COVID-19 - even if not following airborne precautions
- COVID-19 is likely a continuum:
  - 1) Initially, direct injury to tissues then immunologic or para-infectious syndromes that may require hospitalization
  - 2) By the time a patient with COVID requires hospitalization, their infectiousness has likely decreased
  - 3) It is now clearly recognized that presence of viral RNA does not equal risk of transmission
- Setting is also very important
  - ➔ How big is the space?
  - ➔ If outdoors, the risk is tremendously decreased as air flows freely - greatly decreasing the possibility of breathing “the same air.”
  - ➔ Indoors, the more air exchanges, the lesser the likelihood of spread  
Fortunately, most hospitals have implemented an increased number of air exchanges likely decreasing the possibility of airborne transmission of pathogens in hospitals

Salina G. <http://haicontroversies.blogspot.com/2020/06/covid-19-can-have-airborne-transmission.html>

# Small Particle Aerosol Transmission (SPAT)

**Small Particle Aerosol Transmission (or SPAT)** - viruses can remain suspended in aerosols and travel distances > 1-2 meters (3-6 feet)

- Viruses released during exhalation, talking, and coughing in microdroplets small enough to remain aloft in air and pose a risk of exposure at distances beyond 1 to 2 m (3-6 feet) from an infected individual
- Viral RNA associated with droplets smaller than 5  $\mu\text{m}$  (micron) has been detected in air
- Virus has been shown to maintain infectivity in droplets of this size - important to distinguish SPAT from “classic airborne transmission”

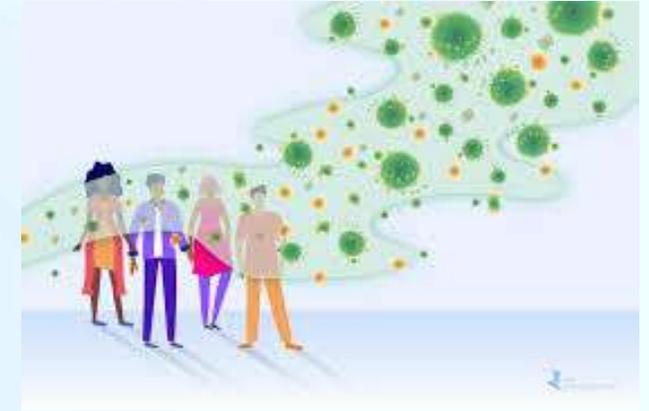


Photo credit: creakyjoints.org

<https://www.who.int/news-room/commentaries/detail/transmission-of-sars-cov-2-implications-for-infection-prevention-precautions>

# SPAT vs Airborne

- Term “airborne” implies a common set of “one-size fits all” interventions to prevent transmission
- Require resource-intensive engineering controls and PPE requirements
- It is not at all clear that such interventions are required to prevent transmission of SPAT pathogens
- Most evidence (and real-world experience) suggests that they are not
- Therefore the droplet-airborne dichotomy has served us well over the years—droplet precautions appear to be effective at preventing SPAT



# Airborne Transmission – *Clinical Infectious Diseases* 7-6-2020

- Over 230 experts have signed an open letter to the WHO recommending:  
“ it’s time to recognize evidence that the coronavirus is airborne”
- The published letter argues that the public health institution must update its prevention recommendations to help people avoid those risks.

*“It is understood that there is not as yet universal acceptance of airborne transmission of SARS-CoV2; but in our collective assessment there is more than enough supporting evidence so that the precautionary principle should apply. In order to control the pandemic, pending the availability of a vaccine, all routes of transmission must be interrupted.”*

*Ref: Clinical Infectious Diseases – July 6, 2020*

# WHO – Update July 9, 2020 - COVID-19 Can Be Airborne Indoors

- Airborne transmission of SARS-CoV-2 can occur during medical procedures that generate “aerosol generating procedures” (AGP)
- WHO - SARS-CoV-2 may also spread through aerosols in the absence of AGP particularly in indoor settings with poor ventilation
- Physics of exhaled air and flow physics have generated hypotheses about possible mechanisms of SARS-CoV-2 transmission through aerosols
- Epidemiology – clusters and outbreaks – associated with close indoor spaces (bars, churches, homes, schools, restaurants, manufacturing plants, etc.



Photo credit: CDC

<https://www.who.int/news-room/commentaries/detail/transmission-of-sars-cov-2-implications-for-infection-prevention-precautions>

# WHO – Outside Medical Facilities

- “Outbreak reports related to indoor crowded spaces have suggested the possibility of aerosol transmission, combined with droplet transmission
- Short-range aerosol transmission, particularly in specific indoor locations, such as crowded and inadequately ventilated spaces over a prolonged period with infected persons cannot be ruled out
- Detailed investigations suggest that **droplet and fomite transmission** could also explain human-to-human transmission within these clusters
- Close contact environments - small number of cases to many other people (e.g., superspreading event), especially if hand hygiene was not performed and masks were not used when physical distancing was not maintained”

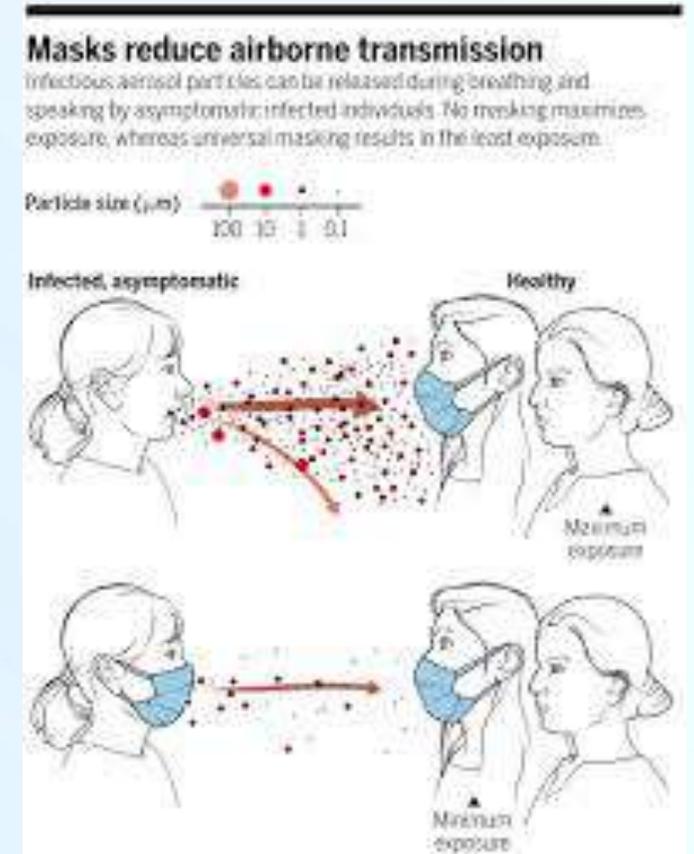


Photo credit: science magazine

# WHO – Theories for Airborne Transmission

- Theories suggest that:
  - A number of respiratory droplets generate microscopic aerosols (<5  $\mu\text{m}$ )
  - Normal breathing and talking results in exhaled aerosols
  - Thus, a susceptible person could inhale aerosols, and could become infected if the aerosols contain the virus in sufficient quantity to cause infection within the recipient
  - However, the proportion of exhaled droplet nuclei or of respiratory droplets that evaporate to generate aerosols, and the infectious dose of viable SARS-CoV-2 required to cause infection in another person are not known, but it has been studied for other respiratory viruses

<https://www.who.int/news-room/commentaries/detail/transmission-of-sars-cov-2-implications-for-infection-prevention-precautions>

# WHO – Studies on Aerosols

- Experimental studies have generated aerosols of infectious samples using high-powered jet nebulizers under controlled laboratory conditions
- Studies found SARS-CoV-2 virus RNA in air samples within aerosols for up to 3 hours in one study and 16 hours in another, which also found viable replication-competent virus
- Experimentally induced aerosols do not reflect normal human cough conditions
- Studies in health care settings where symptomatic COVID-19 patients were cared for, but where aerosol generating procedures were not performed, reported the presence of **SARS-CoV-2** RNA in air samples while other similar investigations in both health care and non-health care settings found no presence of SARS-CoV-2 RNA
- No studies have found **viable virus in air samples**

# Recommendations

1. Provide sufficient and effective ventilation (supply clean outdoor air, minimize recirculating air) particularly in public buildings, workplace environments, schools, hospitals, and aged care homes
2. Supplement general ventilation with airborne infection controls such as local exhaust, high efficiency air filtration, and germicidal ultraviolet lights
3. Avoid overcrowding, particularly in public transport and public buildings



# 7 S Pandemic Bundle for COVID-19

## #1 Screen and Monitor for COVID-19

- Antigen and antibody testing

## #2 Safe Environment

- Disinfectants and long acting antimicrobial solutions
- Ultraviolet lights, robots, small item UV boxes, UV-C 254nm lights, pulsed xenon
- Hydrogen Peroxide for surface disinfection – dry hydrogen peroxide (DHP), vaporized hydrogen peroxide (VHP) binary ionization technology (BIT)
- Air purification and disinfection devices – DHP, UV-C with HEPA filter portable unit, UV-C lighting units

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## #3 Supplies to Protect Healthcare Workers and Public

- Nasal antiseptic – alcohol and citric acid based long acting antiseptic
- Mask – cloth, surgical, Filtering Facepiece Respirators, antimicrobial mask
- Face shield – visors, mask with built in visor, helmets
- Gowns – disposable, cloth reusable, coveralls (“bunny suits”), disposable scrubs/lab coat
- Gloves – nitrile, heavy duty rubber gloves for disinfection
- Footwear – disposable covers, UV-C shoe disinfection step in box
- Engineering controls – plastic shields, plastic barriers, 6ft distance to tables/chairs, counter

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## #4 Sanitizer and Soap – Hand Hygiene

- Soap – liquid preferred in disposable containers to prevent contamination from topping off
- Antimicrobial – immediate and long acting antimicrobials for residual action
- Lotions – for hand protection from contact dermatitis – compatible with soap/antimicrobial
- Electronic hand hygiene systems – monitors compliance
- Alcohol Based Sanitizer - >60% alcohol content
- Hand Hygiene Education

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# 7 **S** Pandemic Bundle for COVID-19

## #5 **S**crubs, Linen and Textiles

- Disposable scrubs, linens, lab coats
- Linen disinfection
- Antimicrobial linens and sheets, cubicle curtains

## #6 **S**ystematic Instruction and Education

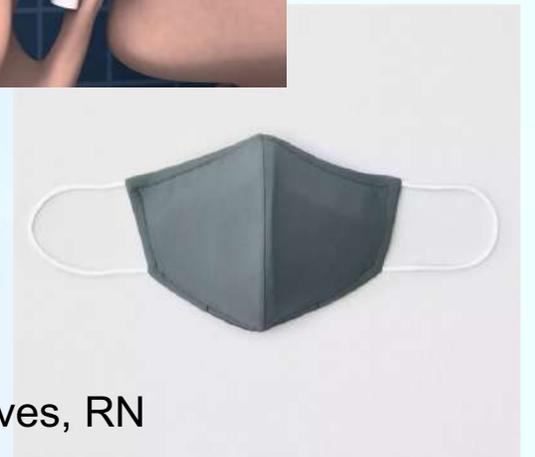
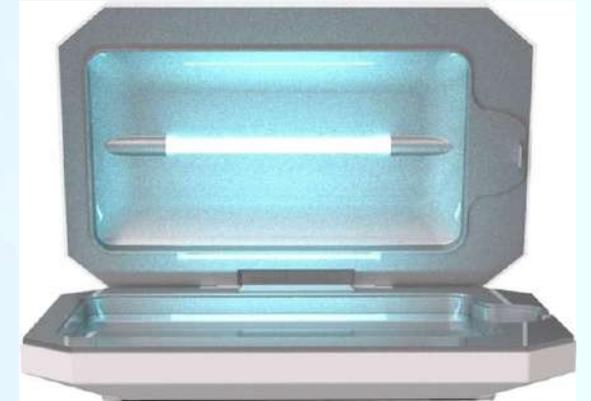
- Online courses and training
- Webinars and assisted learning systems

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## #7 Skin and Personal Hygiene

- UV disinfection boxes for personal device disinfection – 1 min sterilization
- Nasal antiseptic – up to 10hrs protection
- Homemade masks - need two layers
- Antimicrobial masks – silver, copper, long acting antimicrobial solution
- Antimicrobial soaps and sanitizers – over the counter and homemade



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