# COVID-19 'PPE's and other non-pharmaceutical strategies

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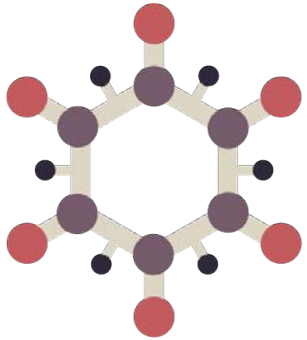
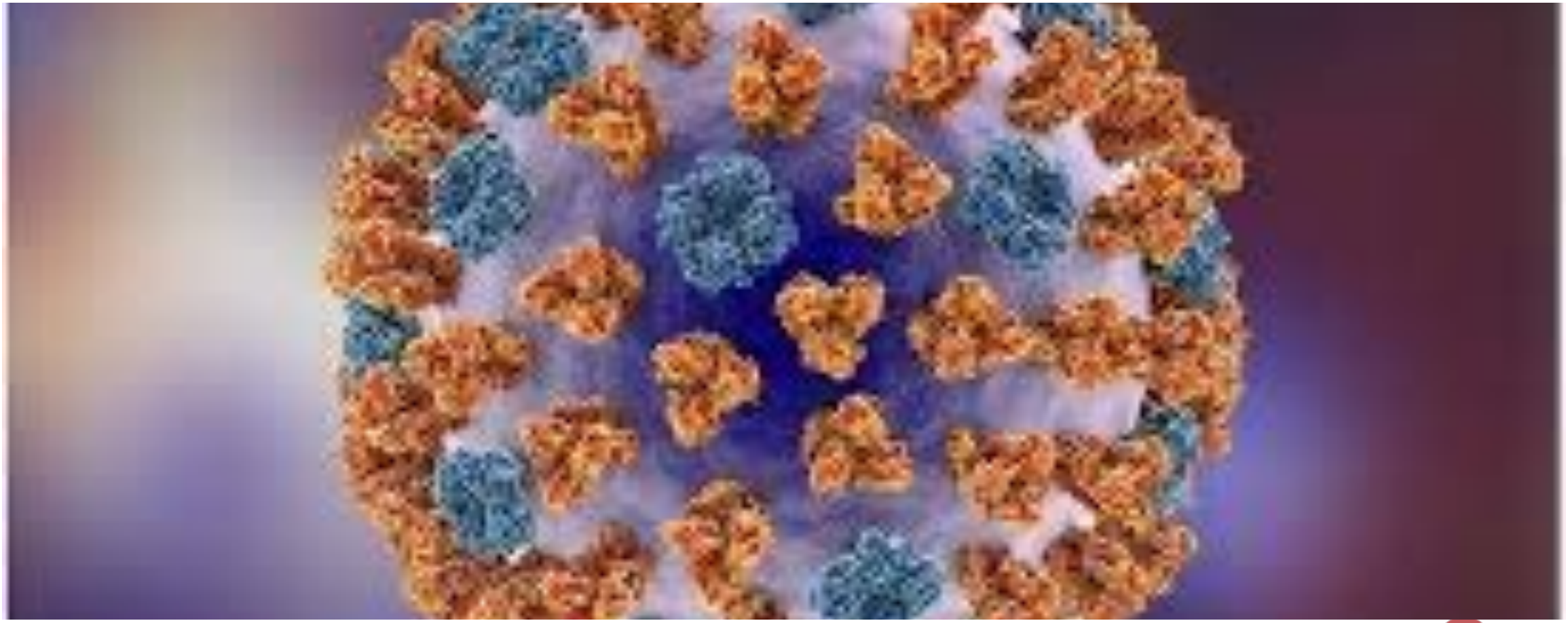


IMMUNISATION
COALITION



# Polling Question

What is the longest duration influenza A can survive as fomite (contaminated surfaces) ?

- 0-6 hours
- 7-9 hours
- 1-3 days
- >4 days

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# Fomite

**1982** influenza A virus remained infectious up to 48 hours: hard plastic & stainless steel

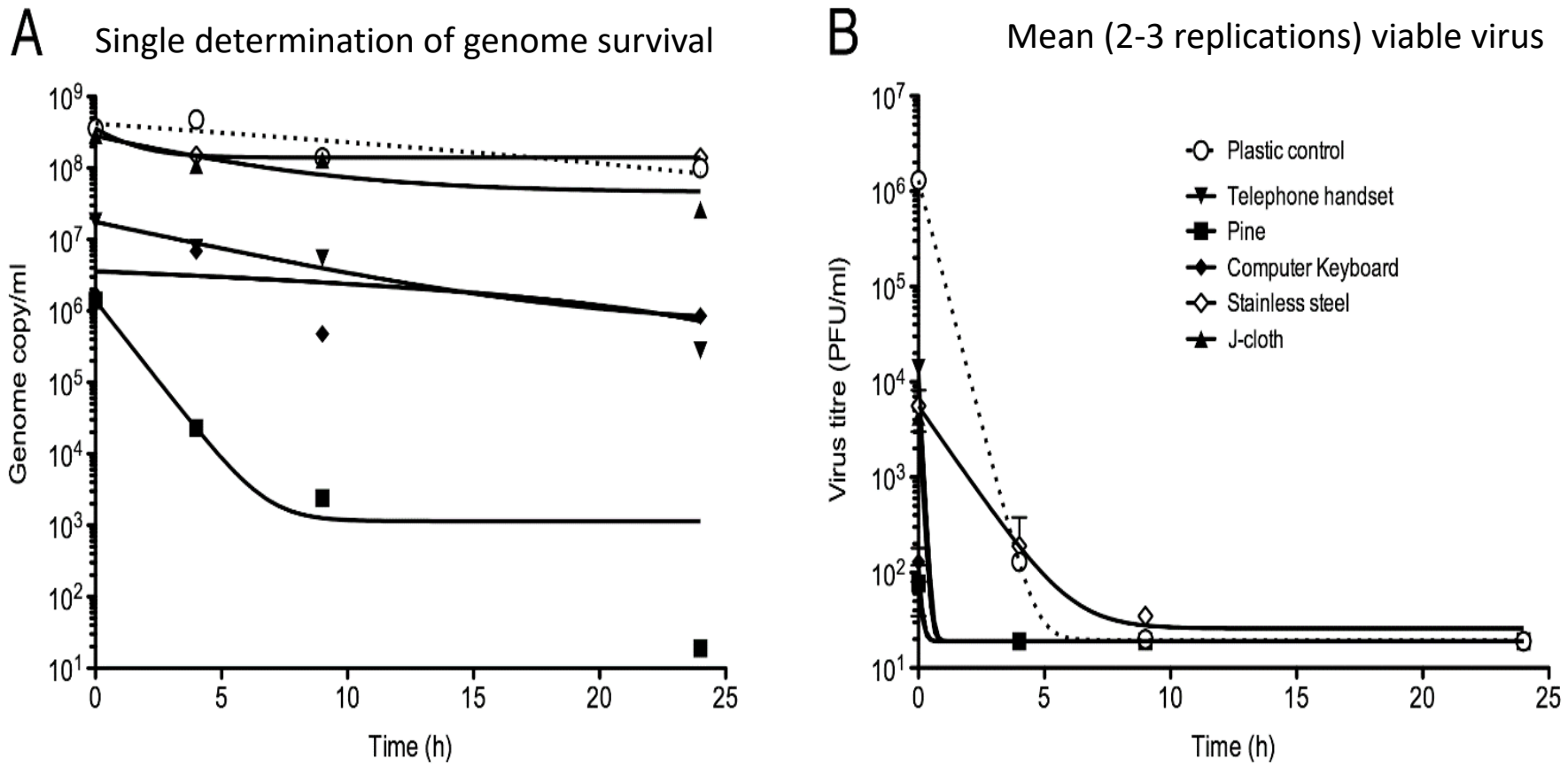
**2006** influenza H1N1 viruses persisted up to 6 days: non-porous surfaces than porous ones

**2008** influenza A virus infectious up to 3 days: Swiss bank notes

**2011** two strains of influenza A infectious: variety common surfaces

Vasickova P, Pavlik I, Verani M. *et al.* Issues Concerning Survival of Viruses on Surfaces. *Food Environ Virol* 2010; **2:** 24–34. https://doi.org/10.1007/s12560-010-9025-6

# Fomite: Influenza A(H1N1)




Greatorex JS, Digard P, Curran MD, Moynihan R, Wensley H, et al. Survival of Influenza A(H1N1) on Materials Found in Households: Implications for Infection Control. PLoS ONE 2011; 6(11): e27932. doi:10.1371/journal.pone.0027932

# Fomite: Influenza A (H1N1)

## High touch household surfaces

survival 4-9 hours:

- light switch material (polyvinyl chloride)
- computer keyboard

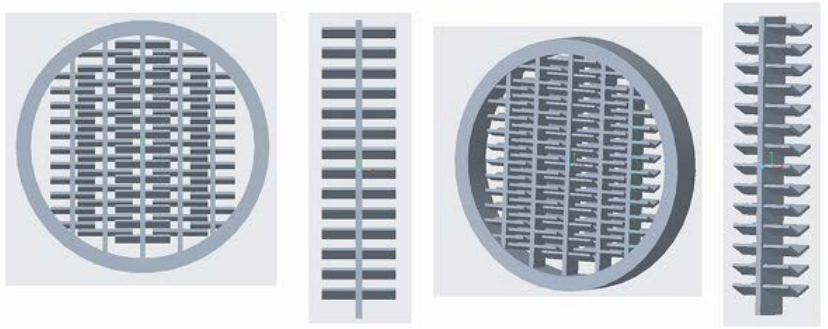
survived <4hours:

- wood surfaces
- stainless steel longer than other metals

Greatorex JS, Digard P, Curran MD, Moynihan R, Wensley H, et al. (2011) Survival of Influenza A(H1N1) on Materials Found in Households: Implications for Infection Control. PLoS ONE 6(11): e27932. doi:10.1371/journal.pone.0027932

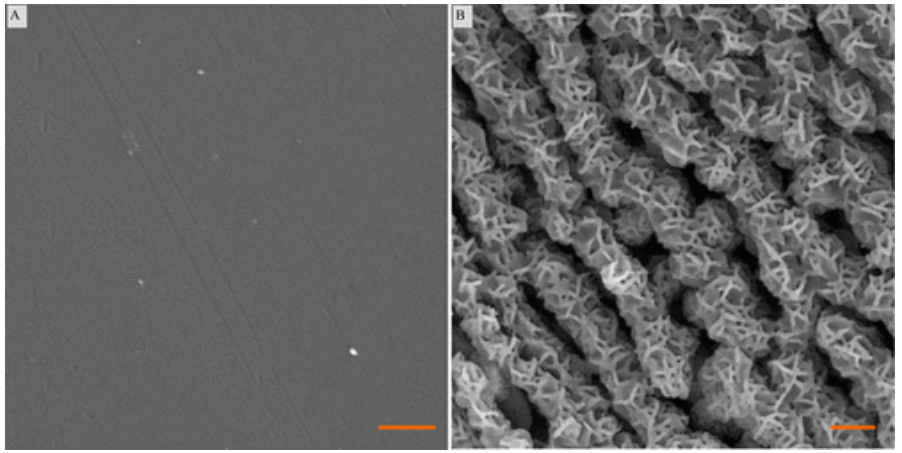
# Fomite: surface modification

3D printed copper coated plastic mask filters based on fish gills



Centre for Biomedical Technologies QUT

nano-structured aluminium surfaces inactivate SARS-CoV-2 within 6 hours vs 48 hours on smooth surfaces




Jafar Hasan, Yanan Xu, Tejasri Yarlagadda, Michael Schuetz, Kirsten Spann, and Prasad KDV Yarlagadda, Antiviral and Antibacterial Nanostructured Surfaces with Excellent Mechanical Properties for Hospital Applications *ACS Biomaterials Science & Engineering* 2020 *6* (6), 3608-3618 DOI: 10.1021/acsbiomaterials.0c00348

# Droplet and airborne: Influenza & respiratory infections

- Symptomatic patients: 12 adult and 41 Paediatric
- Modified six-stage Andersen Sampler collected expelled particles
- Each stage washed to recover viral RNA extraction

Gralton J, Tovey ER, McLaws ML, Rawlinson WD. Respiratory virus RNA is detectable in airborne and droplet particles. J Med Virology 2013. https://doi.org/10.1002/jmv.23698

# Droplet and airborne: Influenza & respiratory infections

## RT-PCR detected

- Influenza A and B
- parainfluenza 1, 2, 3
- respiratory syncytial virus
- human metapneumovirus
- human rhinoviruses

Gralton J, Tovey ER, McLaws ML, Rawlinson WD. Respiratory virus RNA is detectable in airborne and droplet particles. J Med Virology 2013. https://doi.org/10.1002/jmv.23698

# Polling Question:

Is influenza A exhaled as:

- Droplet size particles i.e. >5 µm
- Aerosol size particles i.e. ≤5 µm
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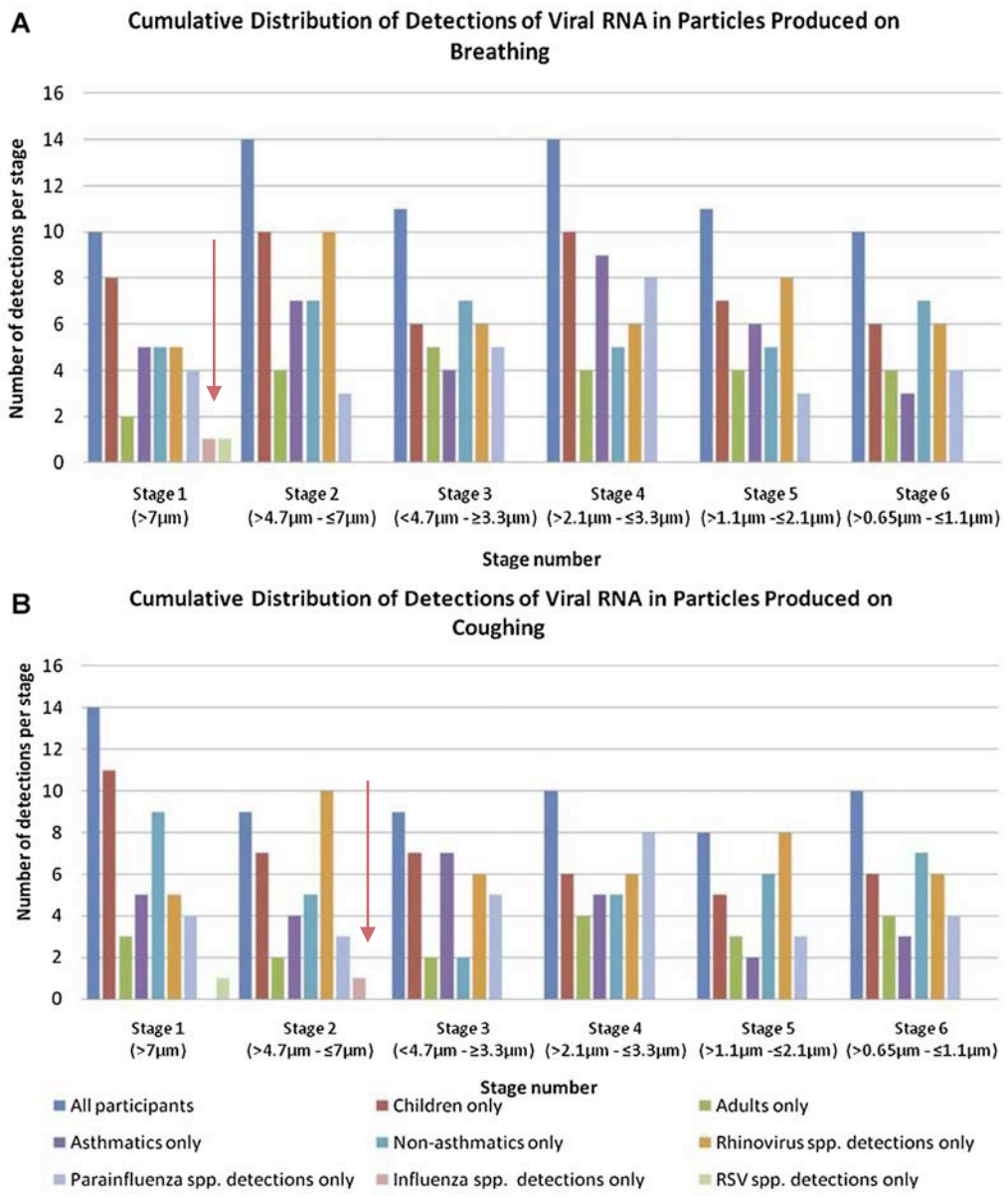


**Participants produced particles containing RNA**

**Participants breathing**

58% produced >5 µm

80% produced ≤5 µm

**Participants coughing**

57% produced >5 µm

82% produced ≤5 µm

# Droplet and airborne: Influenza & respiratory infections

## Conclusion

Symptomatic respiratory viral infections produce

**both >5 µm and ≤5 µm** particles carrying viral RNA

coughing and breathing

Gralton J, Tovey ER, McLaws ML, Rawlinson WD. Respiratory virus RNA is detectable in airborne and droplet particles. J Med Virology 2013. https://doi.org/10.1002/jmv.23698

# Conclusion: Influenza A (H1N1)

1. Exhaled in both droplet and airborne particle sizes
2. Indoor domestic surfaces, temperate zones: survive up to a few hours, **rarely more than 9 hours**
3. Metallic/ non-metallic non-porous materials: greatest risk and need targeted frequent cleaning esp close proximity to patients infected with influenza
4. Supports frequent cleaning commonly touched items and surfaces throughout the working day esp with symptomatic patients e.g. physician waiting rooms

Greatorex JS, Digard P, Curran MD, Moynihan R, Wensley H, et al. (2011) Survival of Influenza A(H1N1) on Materials Found in Households: Implications for Infection Control. PLoS ONE 6(11): e27932. doi:10.1371/journal.pone.0027932

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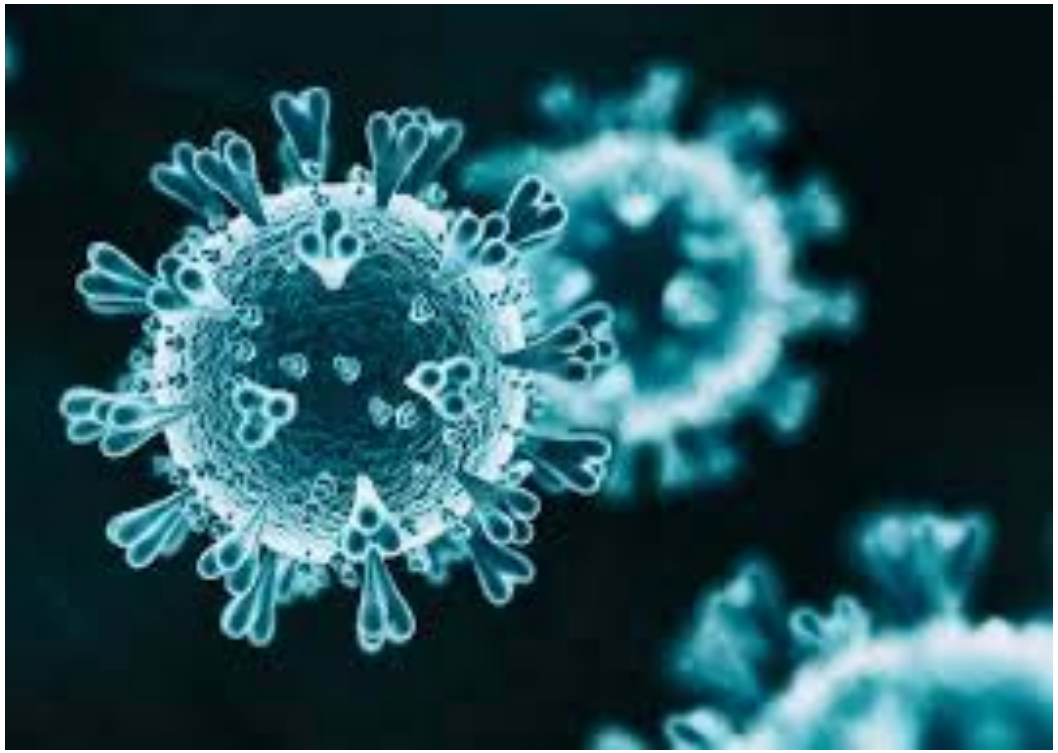

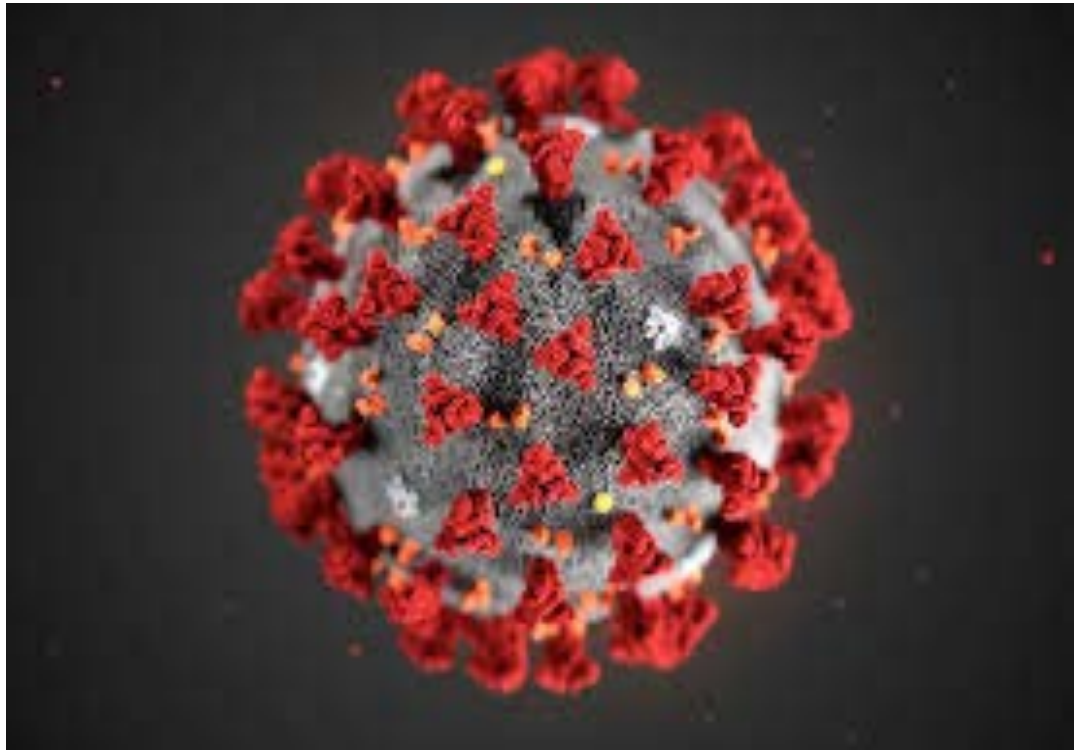

## Polling Question:

How are the modes of transmission for SARS-CoV-2 ?

- Mostly Fomite spread
- Mostly Droplet spread
- Fomite and droplet spread
- Mostly Airborne spread
- Mostly Airborne and droplet spread
- Droplet, fomite and airborne spread in the right conditions

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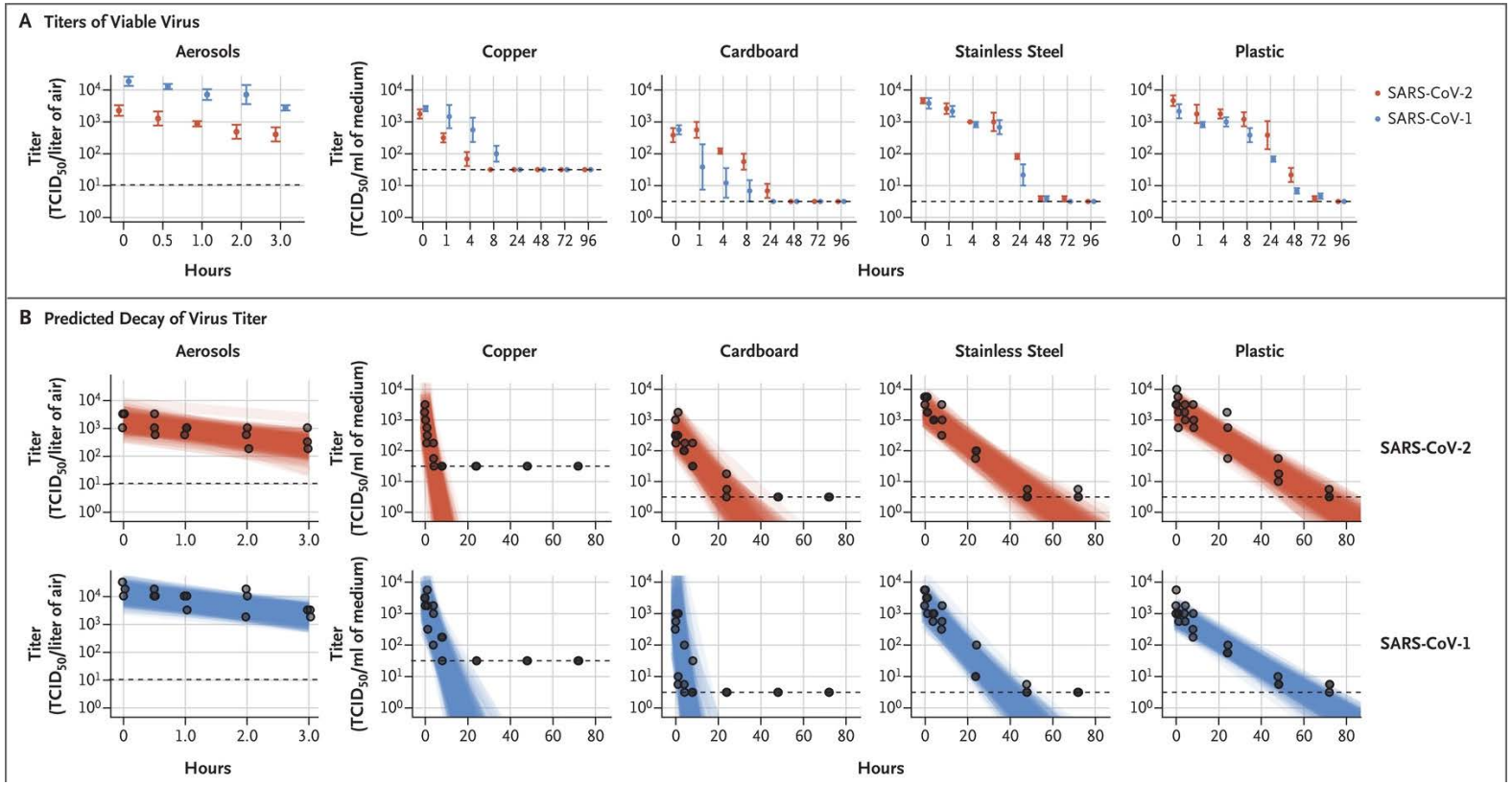
Respiratory ***secretions or droplets expelled*** by infected individuals can contaminate surfaces and objects, creating fomites (contaminated surfaces). ***Viable SARS-CoV-2 virus*** and/or RNA detected by RT-PCR can be found on those surfaces for periods ranging from hours to days, ***depending on the ambient environment*** (including ***temperature and humidity***) and the ***type of surface***, in particular at high concentration in health care facilities where COVID-19 patients were being treated.*(21, 23, 24, 26, 28, 31-33, 36, 44, 45)* Therefore, transmission may also occur indirectly through touching surfaces in the immediate environment or objects contaminated with virus from an infected person (e.g. stethoscope or thermometer), followed by touching the mouth, nose, or eyes.

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

# Fomite: SARS-CoV-1 & SARS-CoV-2




| Viability (hrs) | SARS-CoV-1 | SARS-CoV-2 |
|---|---|---|
| Aerosol | >3 | >3 |
| Copper | 8 | 4 |
| Cardboard | 8 | 24 |
| Stainless steel | 48 | 48 |
| Plastic | 72 | 72 |

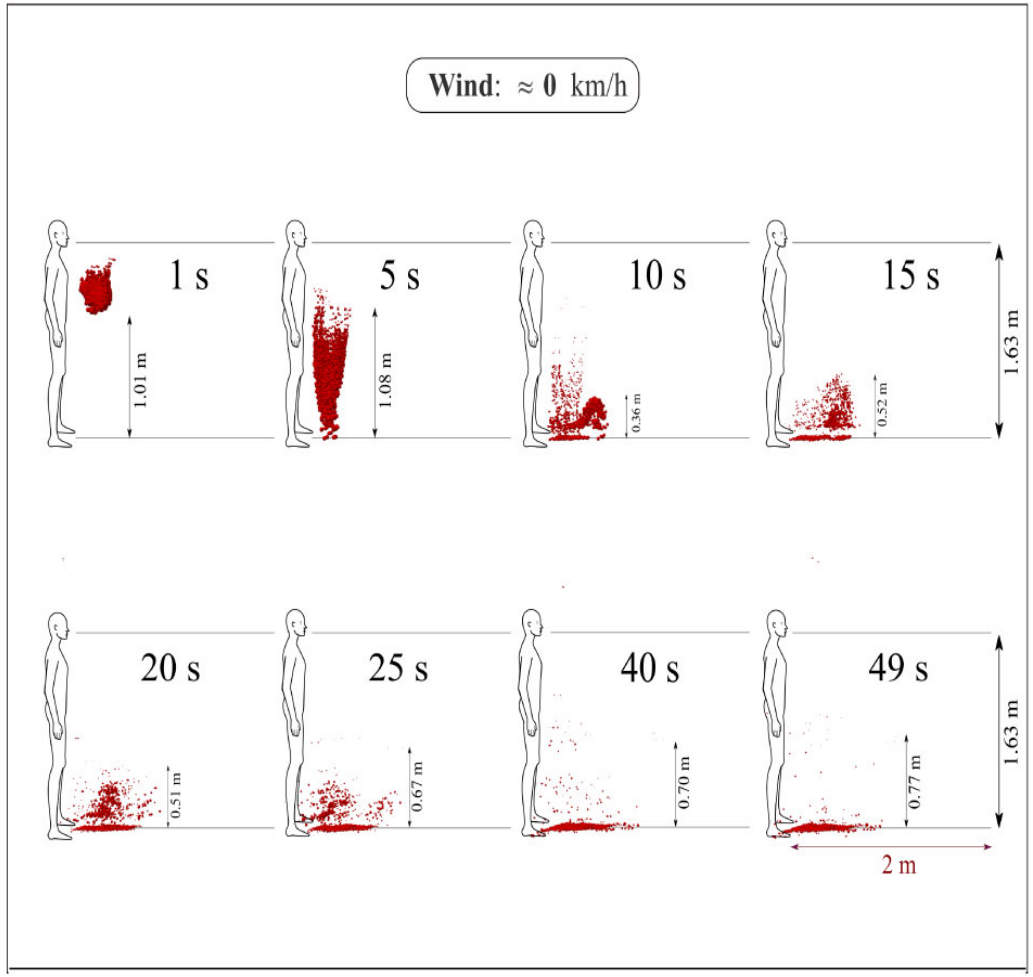
van Doremalen N et al. Aerosol and surface stability of HCoV-19 (SARS-CoV-2) compared to SARS-CoV-1. New Eng Med 2020 DOI: 10.1056/NEJMc2004973

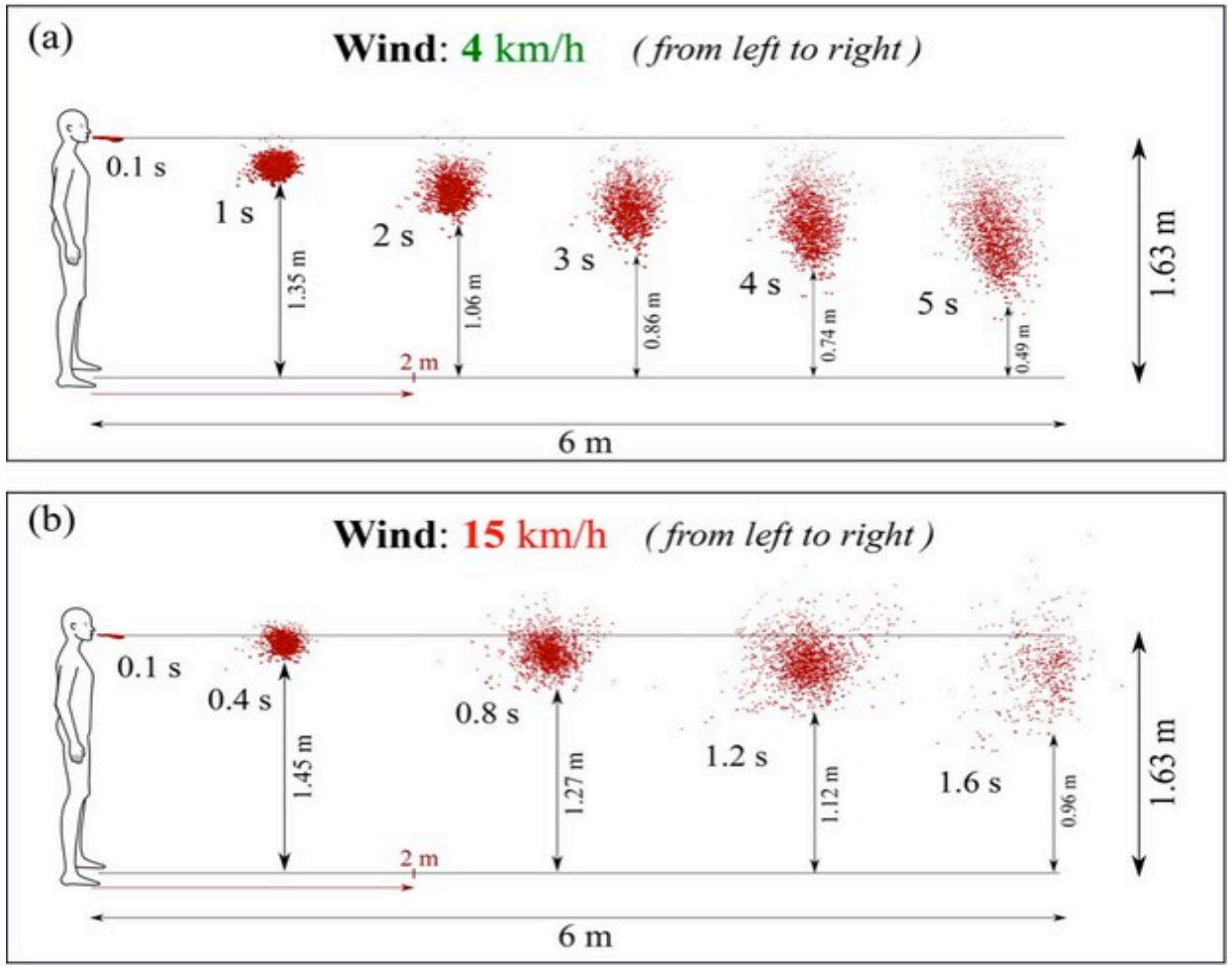
# Droplet vs airborne

UNIVERSITY of NICOSIA

**On Coughing and Airborne Droplet Transmission to Humans**

Talib Dbouk and Dimitris Drikakis
University of Nicosia, Nicosia, Cyprus




www.unic.ac.cy/coronavirus/airborne-transmission


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.*(17)*

Another recent experimental model found that ***healthy individuals can produce aerosols*** through coughing and talking *(19)*, and another model suggested ***high variability*** between individuals in terms of particle emission rates during speech, with increased rates correlated with increased amplitude of vocalization.*(20)*


Outside of medical facilities, some outbreak reports related to ***indoor crowded space***s *(40)* have suggested the possibility of aerosol transmission, combined with droplet transmission, for example, during choir practice *(7)*, in restaurants *(41)* or in fitness classes.*(42 )* In ***these events***, ***short-range aerosol transmission***, particularly in specific indoor locations***, such as crowded and inadequately ventilated s*****paces** over a prolonged period of time with infected persons cannot be ruled out. However, the detailed investigations of these clusters suggest that ***droplet and fomite*** transmission **could also** explain human-to-human transmission within these clusters. Further, the close contact environments of these clusters may have facilitated transmission from a 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.*(43 )*

# Conclusions

- Exhalation both small and large particles
- Mostly droplet and fomite spread
- Infectious dose is unknown
- Airflow important for opportunistic airborne spread


….. evidence suggests that SARS-CoV-2 RNA can be detected in people ***1-3 days before their symptom onset***, with the ***highest viral loads***, as measured by RT-PCR, observed around ***the day of symptom onset,*** followed by a gradual decline over time.*(47, 62-65)*
The ***duration of RT-PCR positivity*** generally appears to be ***1-2 weeks for asymptomatic*** persons, and ***up to 3 weeks or more for patients with mild to moderate disease***.*(62, 65-68)*
In patients with severe COVID-19 disease, it can be much longer.*(47)*

# Conclusion

- SARS-CoV-2 & SARS-CoV-1 similar stability under experimental circumstances

- SARS-CoV-2 & SARS-CoV-1 different epidemiology:

  SARS-CoV-2 asymptomatic case

  SARS-CoV-2 highest viral loads during symptoms (like SARS-CoV-1) but serial interval day 3-5 post exposure

- SARS-CoV-2 transmitted mostly via droplet and fomites with evidence of aerosol in right circumstances

- SARS-CoV-2 OH&S transmission