

AEROSOL TRANSMISSION OF SARS- COV-2: WHAT'S THE EVIDENCE?

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GAME PLAN FOR TODAY

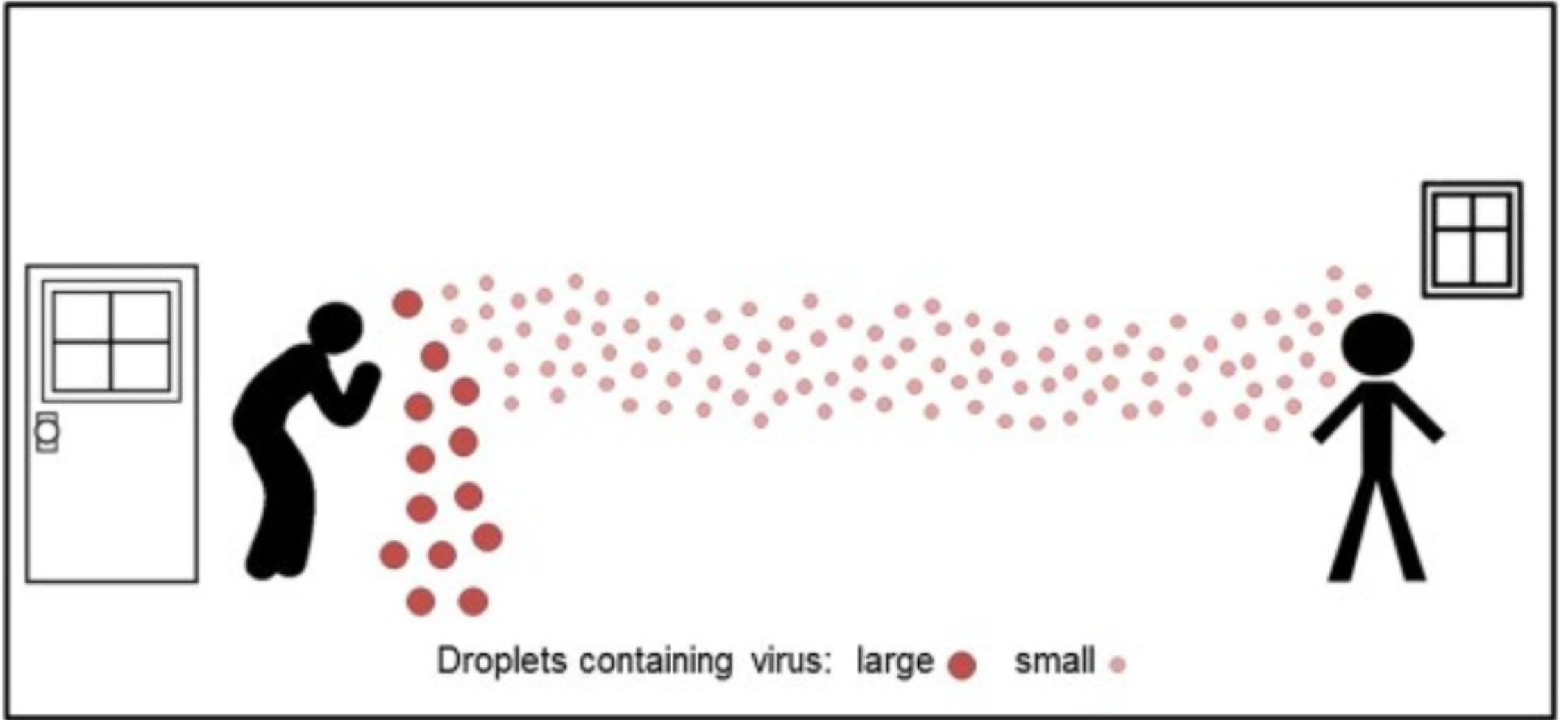
- Quickly review the controversy re: small droplet spread of SARS-CoV-2 via droplet nuclei that hang in the air
- WHO stance on the topic
- News-worthy studies in scientific and lay reports

OBJECTIVES

- Define differences in droplet spread via droplet nuclei for any airborne infection
- Summarize evidence pro and con for need for better protection from aerosol-borne SARS-CoV-2 (and development of COVID-19 disease)

TAKE HOME MESSAGES

- WHO has not embraced aerosol spread as a major cause of transmission, except for medical procedures with COVID patients as of April, 2020 summary. Some 'revision' last week (“may be important mechanism in communities”)
- New reports show evidence of virions (infectious particles) in the air for long periods of time, in lab setting—as well as identification of Cov-2 RNA in air samples from other environmental studies
- Clusters of cases suggested from China and Seattle raise concerns about aerosol transmission
- The jury is still out, tho strong warnings are increasing among public health officials and lab scientists (last week)



AREA OF GROWING CONCERN

- <https://www.who.int/news-room/q-a-detail/q-a-how-is-covid-19-transmitted> includes, “There have been reported outbreaks of COVID-19 in some closed settings, such as restaurants, nightclubs, places of worship or places of work where people may be shouting, talking, or singing. In these outbreaks, aerosol transmission, particularly in these indoor locations where there are crowded and inadequately ventilated spaces where infected persons spend long periods of time with others, cannot be ruled out. More studies are urgently needed to investigate such instances and assess their significance for transmission of COVID-19.”

DEFINITIONS

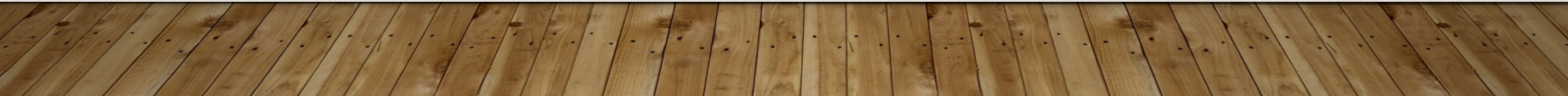
- Virion: the infectious virus particle (just RNA or DNA evidence is different)
- Respiratory droplets 5-10 micrometers in diameter. These are widely recognized vehicles for multiple respiratory infections, travelling several yards before settling out of the air
- Droplet nuclei <5 micrometers (our concern today), that can persist in the air a longer time before settling
- Most public health warnings center on respiratory droplets, and transmission to nose/mouth/eyes...directly or thru recently contaminated surfaces—and do not mention aerosols that can travel long distances in air currents

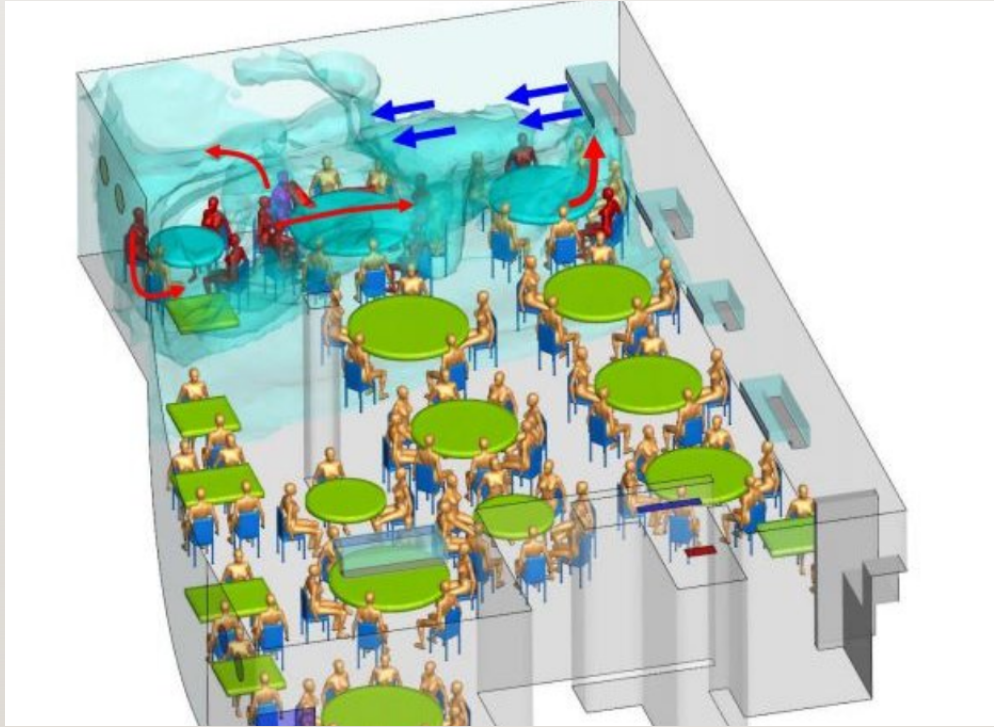
LIU REPORT: SARS-COV-2 AEROSOL SAMPLING IN CHINESE HOSPITAL

- 35 specimens from one hospital, identification of viral RNA (not virions) in air and on surfaces, using PCR
- Patient rooms and hospital hallways...no RNA
- ICU deposition and restroom air positive for RNA
- Authors suggested ventilation and open space/large rooms to decrease air spread of virus

MOROWSKA REF: THE WORLD SHOULD FACE THE REALITY OF AEROSOL SPREAD...

- SARS-CoV-2 spread in air, evidence 'well supported'
- On cruise ships, many infections occurred after lockdown/confinement to rooms, implicating ventilation systems
- Growing body of lab evidence suggests importance of aerosol spread
- Current limitations on actually measuring virus in the air in 'typical rooms', given flow dynamics, dilution, etc
- Will take several more months for virologists and other scientists to thoroughly convince health planners of the importance of this mode of transmission





LETTER TO WHO, THE 'FIXES':

- Increased ventilation in public buildings
- Exhaust control so air in buildings does not pose a risk when exhaust is in use
- Avoid overcrowding

FEARS REF: PERSISTENCE OF SARS-COV-2

- Lab based study under controlled conditions
- Viruses were shot via nebulizer into a closed chamber
- Viruses recovered at different time periods, up to 16 hours, with retained morphology (and presumed infectiousness as with the original samples) as seen on EM
- “Aerosol transmission may be more important than previously thought...the virus has ‘aerosol fitness’.”

SUMMARY ARTICLE BY ARSHAN ET AL

- SARS-CoV-2 recovered from the air for 3 hours after aerosol shot into lab contained space (van Dormalen et al, 2020)
- Hospital environment in China showed 300-1100 copies/cubic meter of air (Zhang et al, 2020)
- Coccia (2020) suggested (did not measure, tho) that CoV-2 can cling to pollution particulate matter and thus spread disease in that manner (observations from Italy)

HOW CAN WE STUDY THIS ISSUE?

- Lab studies in large space aerosolization experiments, perhaps with susceptible animal models that are antibody negative and develop signs of disease...measuring indoor airflow patterns
- ? Detailed contact tracing information (from infected people who only go infrequently to indoor settings, who wear masks all the time while in those settings, and where everyone else wears masks all the time, and who live alone) AND recovery of copies of CoV2 from said environmental air samples at 5-6 feet elevation
- The 'usual study designs', both laboratory and epi, will be challenging to conduct

REFERENCES

- Arslan, M., Xu, B ., & Gamal El-Din, M. (2020). **Transmission of SARS-CoV-2 via fecal-oral and aerosols–borne routes: Environmental dynamics and implications for wastewater management in underprivileged societies.** *The Science of the Total Environment*, 743, 140709. <https://doi.org/10.1016/j.scitotenv.2020.140709>.
- Morawska, L., & Cao, J. (2020). **Airborne transmission of SARS-CoV-2: The world should face the reality.** *Environment International*, 105730. <https://doi.org/10.1016/j.envint.2020.105730>