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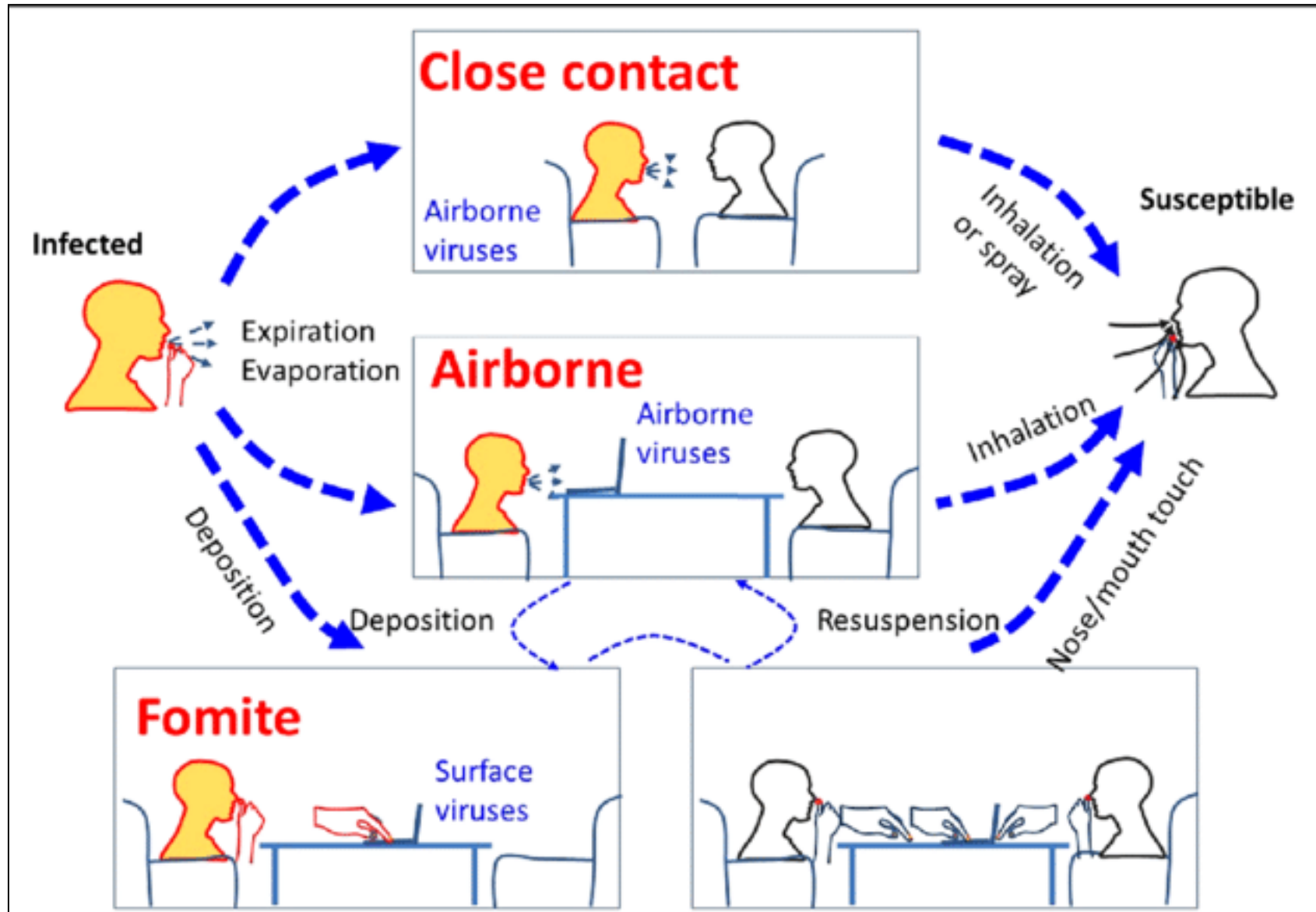
Airborne and Droplet Transmission of COVID-19

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2020

Transmission routes of respiratory infection



Definitions

“airborne or aerosol transmission”, “droplet transmission”

- ❖ The **5 μ m diameter threshold** used to differentiate droplet from airborne is an over-simplification of multiple complex.
- ❖ Airborne transmission refers to the presence of microbes within droplet nuclei (particles $<5\mu$ m in diameter) can remain in the air for long periods of time and be **transmitted to others over distances greater than 1 m.**
- ❖ Droplet transmission occurs when a person is in close contact (**within 1 m**) with someone who has respiratory symptoms.

WHO, 2020



Definitions

“airborne or aerosol transmission”, “droplet transmission”



- “airborne transmission” to mean transmission by aerosol-size particles of $< 10 \mu\text{m}$. (The Infectious Diseases Society of America (IDSA))
- One should note that “aerosol” is essentially a **relative** and **not an absolute** term.
- However, in some situations, such as where there are **strong ambient air cross-flows** larger droplets ($>20 \mu\text{m}$) can behave like aerosols with the potential to transmit infection via this route.



Mechanisms of Airborne Viral Particle Formation

- ❖ open-close cycling of glottic structures ($> 1\mu\text{m}$)
- ❖ shearing forces due to high velocity gas flow ($2\text{--}5\mu\text{m}$)
(tidal breathing may generate airflow velocities up to 1 m/s, talking 5 m/s, coughing 2–50 m/s and sneezing $> 100\text{ m/s}$)
- ❖ open-close cycling of terminal bronchiole airways ($< 1\mu\text{m}$)



Aerosol particles during breathing, coughing and sneezing

Ordinary speech = ~ 10 particles/second.

A ten-minute conversation = ~ 6,000 aerosol particles.

Activities	Created Particles
Normal breathing	<0.8 to 2.0 μm
Speaking	16 to 125 μm <0.8 to 7.0 μm 1.0 μm for shouting
Coughing	0.6 to 16 μm 40 to 125 μm
Sneezing	7 to 125 μm



The evidence so far

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NEWS · 02 APRIL 2020

Is the coronavirus airborne? Experts can't agree

WHO, March 27, 2020.

There is not **sufficient evidence to suggest** that SARS-CoV-2 is airborne, **except** in a handful of medical contexts, such as when intubating an infected patient.

The evidence so far

US. CDC:

The contribution of **small respirable particles, sometimes called aerosols or droplet nuclei**, to close proximity transmission is currently **uncertain**.

However, **airborne transmission** from person-to-person over long distances is **unlikely**.



The evidence so far

nature

<https://doi.org/10.1038/s41586-020-2271-3>

Accelerated Article Preview

Aerodynamic analysis of SARS-CoV-2 in two Wuhan hospitals

Received: 14 March 2020

Accepted: 20 April 2020

Yuan Liu, Zhi Ning, Yu Chen, Ming Guo, Yingle Liu, Nirmal Kumar Gali, Li Sun, Yusen Duan, Jing Cai, Dane Westerdahl, Xinjin Liu, Ke Xu, Kin-fai Ho, Haldong Kan, Qingyan Fu & Ke Lan

Aerosols samples of in and around hospitals treating people with COVID-19, as well as at the busy entrances of two department stores.

They report finding viral RNA from SARS-CoV-2 in a number of locations, **including the department stores.**



Accelerated Article Preview

Aerodynamic analysis of SARS-CoV-2 in two Wuhan hospitals



The evidence so far

The NEW ENGLAND JOURNAL of MEDICINE

CORRESPONDENCE



Aerosol and Surface Stability of SARS-CoV-2 as Compared with SARS-CoV-1

- In this **experimental** study, aerosols were generated using a **three-jet Collison nebulizer under controlled laboratory** conditions.
- SARS-CoV-2 remained viable in aerosols throughout the duration of 3hours.



The evidence so far

RESEARCH LETTER

Air, Surface Environmental, and Personal Protective Equipment Contamination by Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) From a Symptomatic Patient

JAMA April 28, 2020 Volume 323, Number 16

- ❖ Air samples were **negative** despite the extent of environmental contamination.



The evidence so far



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پژوهشکده محیط زیست دانشگاه علوم پزشکی تهران

A field indoor air measurement of SARS-CoV-2 in the patient rooms of the largest hospital in Iran



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In this study all air samples which were collected 2 to 5 m from the patients' beds with confirmed COVID-19 were negative.



Gaps to fill

- Is the virus infectious in droplets of different sizes?
- Air sampling from people when they talk, breathe, cough and sneeze and testing for viable virus in those samples
- Infectious dose
- length of exposure



Conclusion

- Airborne transmission is debated.
- Aerosol spread could occur; thought to be mostly in hospital settings.
- Some widely publicized evidence is based on experimental aerosolization rather than human studies.
- To date, there has not been a well documented case of aerosol transmission

