Artigo muito bem escrito e de extrema lucidez, de autoria da Prof. Lisa Brosseau, da Universidade de Illinois. Copiei os trechos mais importantes para quem quiser uma leitura mais resumida. O texto completo está disponível em:
http://www.cidrap.umn.edu/news-perspective/2020/03/commentary-covid-19-transmission-messages-should-hinge-science

Antes de iniciar, vejamos as definições do CDC sobre os modos de transmissão de doenças infecciosas. **Link aqui**.

Droplet transmission

- Droplet transmission is, technically, a form of contact transmission, and some infectious agents transmitted by the droplet route also may be transmitted by the direct and indirect contact routes.
- However, in contrast to contact transmission, respiratory droplets carrying infectious pathogens transmit infection when they travel directly from the respiratory tract of the infectious individual to susceptible mucosal surfaces of the recipient, generally over short distances, necessitating facial protection.
- Respiratory droplets are generated when an infected person coughs, sneezes, or talks or during procedures such as suctioning, endotracheal intubation, cough induction by chest physiotherapy and cardiopulmonary resuscitation.

Airborne transmission

- Airborne transmission occurs by dissemination of either airborne droplet nuclei or small particles in the respirable size range containing infectious agents that remain infective over time and distance (e.g., spores of *Aspergillus* spp, and *Mycobacterium tuberculosis*).
- Microorganisms carried in this manner may be dispersed over long distances by air currents and may be inhaled by susceptible individuals who have not had face-to-face contact with (or been in the same room with) the infectious individual

Duas observações importantes a respeito destas definições e que terão impacto no entendimento do modo de transmissão do coronavírus:

1. *A transmissão por gotículas é uma forma de transmissão por contato. Gotícula da pessoa doente entrando em contato com a mucosa de outra pessoa.*

2. *A transmissão pelo ar através de aerossóis, deve incluir a capacidade de percorrer longas distâncias*

Existe, portanto, uma lacuna aqui, ou seja: a inalação de aerossóis em curta distância. Leiam o texto e deixem suas opiniões.

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Many experts in public health have, for very good reason, voiced frustration at the lack of science-based information they read regarding the ongoing COVID-19 pandemic. And it's OK to say that we're still gathering evidence.

An often ignored, yet important mode of transmission for infectious respiratory diseases—close-range aerosol transmission—needs to be part of the equation, and I'll detail the science on that later on.

Better communication is needed

Infection prevention, medical, and public health professionals should be communicating to everyone that the exact modes of transmission for SARS-CoV-2—are unknown. There are no studies, yet, to support any particular mode of transmission over another.

The precautionary principle suggests we should approach this organism as we would any novel highly transmissible respiratory disease—as a contact, droplet and airborne disease, but with one important caveat: *Short-range aerosol transmission is also a strong possibility*.

Taking lessons from the little we already know about COVID-19 as well as influenza, SARS, and MERS, all of which show many similarities to COVID-19, the precautionary approach suggests that we focus on preventing short-range aerosol transmission in both public and healthcare settings.

We need to strategically protect health workers

For aerosol-generating procedures, the CDC should be recommending respirators with **higher levels** of protection than an N95 filtering facepiece respirator (eg, a powered air-purifying respirator), but at this point, it does not.

In the face of supply shortages, the CDC last week changed its recommendations to allow the use of medical masks instead of respirators, saving the latter for aerosol-generating procedures.[1] **Healthcare organizations must return to using respirators for confirmed and suspected COVID-19 patients when supply chain problems are resolved**. Requirements for airborne infection isolation rooms remain in place. Organizations are encouraged to designate entire units for COVID-19 patient care and develop re-use procedures for personal protective equipment.

In addition to being clearer in its messaging about disease transmission, the CDC should be working hard to ensure there are enough testing kits and laboratories available, purchasing or providing personal protective equipment (including respirators), supporting public health agencies with thoughtful decision-making and policies, and insisting that workers who protect the public are themselves protected.

Mixed messages about COVID-19 transmission

To date there is no direct research-based evidence describing exactly how SARS-CoV-2 is transmitted. Many sources say that COVID-19 is transmitted only by droplets and contact, but guidance from leading public health groups on transmission routes are inconsistent and conflicting.

Droplet transmission is usually defined as "respiratory droplets carrying infectious pathogens that transmit infection when they travel **directly** from the respiratory tract of the infectious individual to susceptible mucosal surfaces of the recipient, generally over short distances, necessitating facial protection."[3]

Close contact involves hand transfer of surface contamination to mouth, nose or eyes, hand washing and gloves being common controls.

The WHO says, "Based on the available evidence, the COVID-19 virus is transmitted between people through close contact and droplets, not by airborne transmission."[4]

Airborne transmission is defined as "dissemination of either airborne droplet nuclei or small particles in the respirable size range containing infectious agents that remain infective over time and distance."[7] An important requirement of airborne transmission is that it can occur only at a long distance from the source, according to the CDC.[8]

In risk communication guidelines for healthcare, however, the WHO states, "COVID-19 appears to spread most easily through close contact with an infected person. When someone who has COVID-19 coughs or sneezes, small droplets are released and, if you are too close, *you can breathe in the virus*" (emphasis added).[9] ***But wait:*** Inhalation is not part of the traditional definition of droplet transmission.

For healthcare organizations, the CDC recommends airborne, in addition to standard (contact) and droplet precautions, for the care of COVID-19 suspected or confirmed patients.[10]

For the general public, the CDC describes SARS-CoV-2 transmission as primarily by droplets from coughs or sneezes, which "land in the mouths or noses of people who are nearby *or possibly inhaled into*

the lungs" (emphasis added).[11] ***But, again,*** inhalation is a new addition to the traditional definition of droplets. In contrast to its recommendations for healthcare, the CDC makes no mention of airborne transmission in public settings.

The Chinese Center for Disease Control and Prevention, which has dealt with by far more COVID-19 cases than any other agency, says that COVID-19 transmission occurs primarily by respiratory droplets and close contact, with the "possibility of aerosol transmission in a relatively closed environment for a long time exposure to high concentrations of aerosols."[12]

Close-range aerosol transmission

Underlying the CDC and WHO statements about transmission is this: ***Inhalation of particles near the source may be an important mode of transmission.***

Based on research now more than 70 years out of date, the infection control paradigm of contact, droplet, and airborne transmission fails to recognize inhalation of small airborne particles very close to an infectious source—ie, within 6 feet.[13]

Some everyday examples might help for illustration. Have you ever seen dust particles traveling through the air in a beam of light? Some of these eventually deposit on surfaces, but many remain airborne for long periods. Have you ever used hairspray or aerosolized cooking oil? Many of those droplets remain airborne nearby as you inhale particles and smell hairspray and cooking oil for several minutes.

The same thing happens when someone coughs or sneezes. Talking, breathing, coughing, and sneezing create an aerosol (a suspension of particles in the air) containing particles in a range of sizes, with viable infectious organisms present in both small and large particles.[14-20]

Infectious aerosols are inhalable

Contrary to popular belief, the larger particles (5 to 15 micrometers [µm]) will not immediately drop to the ground but will remain airborne for several minutes. Smaller particles (less than 5 µm) will remain in the air for many minutes or even hours.

All particles will immediately begin to evaporate (mucus contains a lot of water), which means the range of particle sizes will decrease overall. Smaller particles are more affected by diffusion than gravity, thus making them more likely to remain airborne. In the absence of air currents, airborne particles will disperse slowly throughout a space (see the figures below).

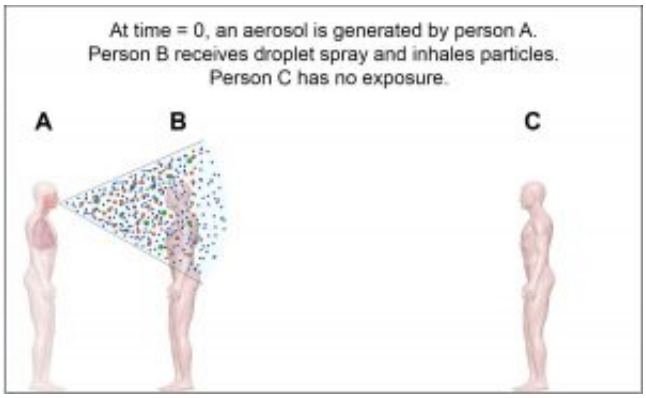

Figure 1. When an aerosol is initially emitted (time = 0), the particles are clustered near the source at location A. A person near the source (location B) may receive large-particle spray and inhale particles of all sizes. Figures: Absolute Science Illustration

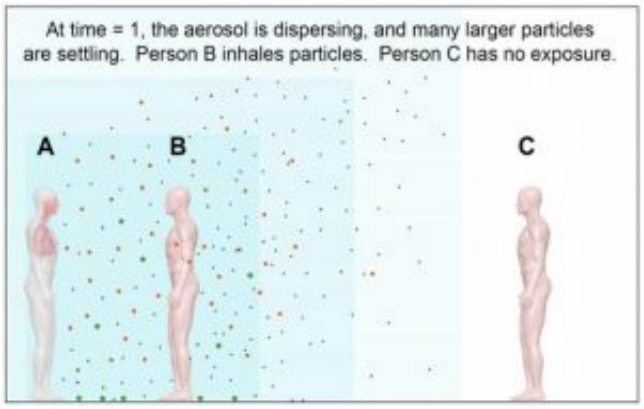

Figure 2. After some time (time = 1), the particles begin to disperse and larger particles begin to settle from the air. Person B will continue to inhale particles of all sizes. Figures: Absolute Science Illustration

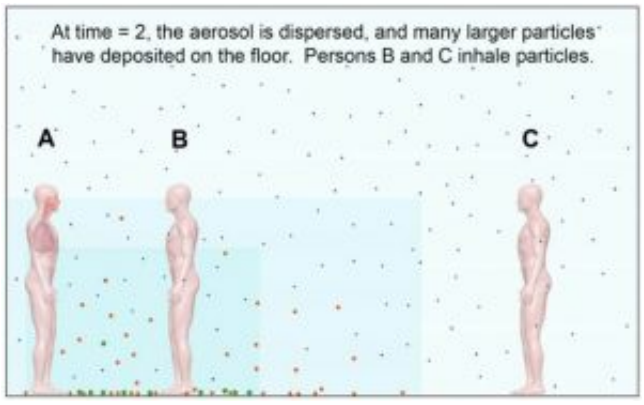

Figure 3. After more time (time = 2), the small particles are uniformly dispersed and more of the larger particles have settled from the air. Persons B and C will

inhale particles that are generally smaller, have a smaller size range, and are at a lower concentration than at time = 0. Figures: Absolute Science Illustration

All of the particle sizes in a typical cough or sneeze aerosol are inhalable. The larger particles will deposit in the nose, while smaller particles deposit in the lungs, where cell receptors for many infectious respiratory viruses are typically located.

Droplet transmission likely less important than thought

Droplet transmission is probably much less important for most respiratory infectious diseases than is short-range aerosol transmission by inhalation. Aerosol particles are not all large, and they do not all immediately fall to the ground. It is rare for coughs or sneezes to be propelled into nearby mouths or noses. The eyes, however, may be a portal of entry for some infectious organisms, such as influenza viruses.[26,27]

What aerosol transmission with other diseases can tell us

The traditional definition of airborne transmission—long-range inhalation of droplet nuclei—arises simply because some organisms are hardier than others. Tuberculosis and measles (classic examples of airborne respiratory diseases) remain viable in air for long periods. Viability dissipates with time, not distance. ***Therefore, diseases that are considered "airborne" must also be capable of transmitting disease by inhalation of aerosols near the source.***

Close-range aerosol transmission

An increasing number of studies with animals and in human settings indicate that close-range aerosol transmission by inhalation is important for influenza.[28-31] SARS and MERS demonstrate increased transmission in healthcare settings, especially to healthcare workers near aerosol-generating procedures. Tellier et al[30] concluded that airborne transmission is likely for these two coronaviruses based on epidemiologic investigations, human respiratory sampling, and lower respiratory tract receptors for MERS.

Transmission in healthcare settings

SARS-CoV and MERS-CoV exhibit high levels of transmission in healthcare settings, in particular during aerosol-generating procedures. More than half of those contracting SARS during the 2003 pandemic were healthcare workers.

These data, along with recent US reports of healthcare worker infections in long-term care facilities and employees on cruise ships, are suggestive of both short- and long-range aerosol transmission in healthcare

and other workplace settings.

Contact transmission of influenza, SARS, and MERS

The possibility of contact transmission and the utility of hand washing for any organism should be informed by scientific data that support biological plausibility (eg, receptors for the organism in the nose, mouth, or eyes) or demonstrate transmission in relevant animal species or humans.

Data support influenza transmission to the eyes in ferrets.[26,27] The effectiveness of hand hygiene in community settings is minimal.[38] Few data are available on contact transmission for SARS or MERS, although it seems unlikely if receptors are located primarily in the lower respiratory tract.[30]

Data are thus only somewhat suggestive of contact as a mode of transmission for COVID-19 in community settings and align with CDC advice that it is not the most important mode.

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Lisa Brosseau

Professor of environmental and occupational health sciences

Biography

Lisa Brosseau is professor of environmental and occupational health sciences in the UIC School of Public Health.

She studies the role of personal protective equipment (such as masks and respirators) and ventilation systems in reducing exposure to dangerous inhalants in health care and small businesses.

Her research focuses on interventions to prevent the inhalation of agents ranging from MERS-CoV and Ebola to wood, metal and paint particulates.

The Center for Infectious Disease Research and Policy published a commentary in September 2014 by Brosseau and Rachael Jones, assistant professor of environmental and occupational health sciences at UIC, stating their belief that Ebola virus has the potential to be transmitted through aerosolized particles. They recommended health care workers wear respirators instead of masks, which offer less protection against infectious aerosolized particles.

Subject areas:

- Aerosol transmission of the Ebola virus and MERS-CoV
- PAPR-powered air-purifying respirators
- Personal protective equipment (PPE)
- Transmission of infectious disease via aerosolized particles
- Occupational health and safety

Lisa Brosseau

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