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HARVARD T.H. CHAN SCHOOL OF PUBLIC HEALTH

Effective actions for a safe return in the tourism sector

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Agenda

Myths about COVID-19 and how they lead to prevention measures with limited or no effectiveness (which is not helpful, but gives people confidence).

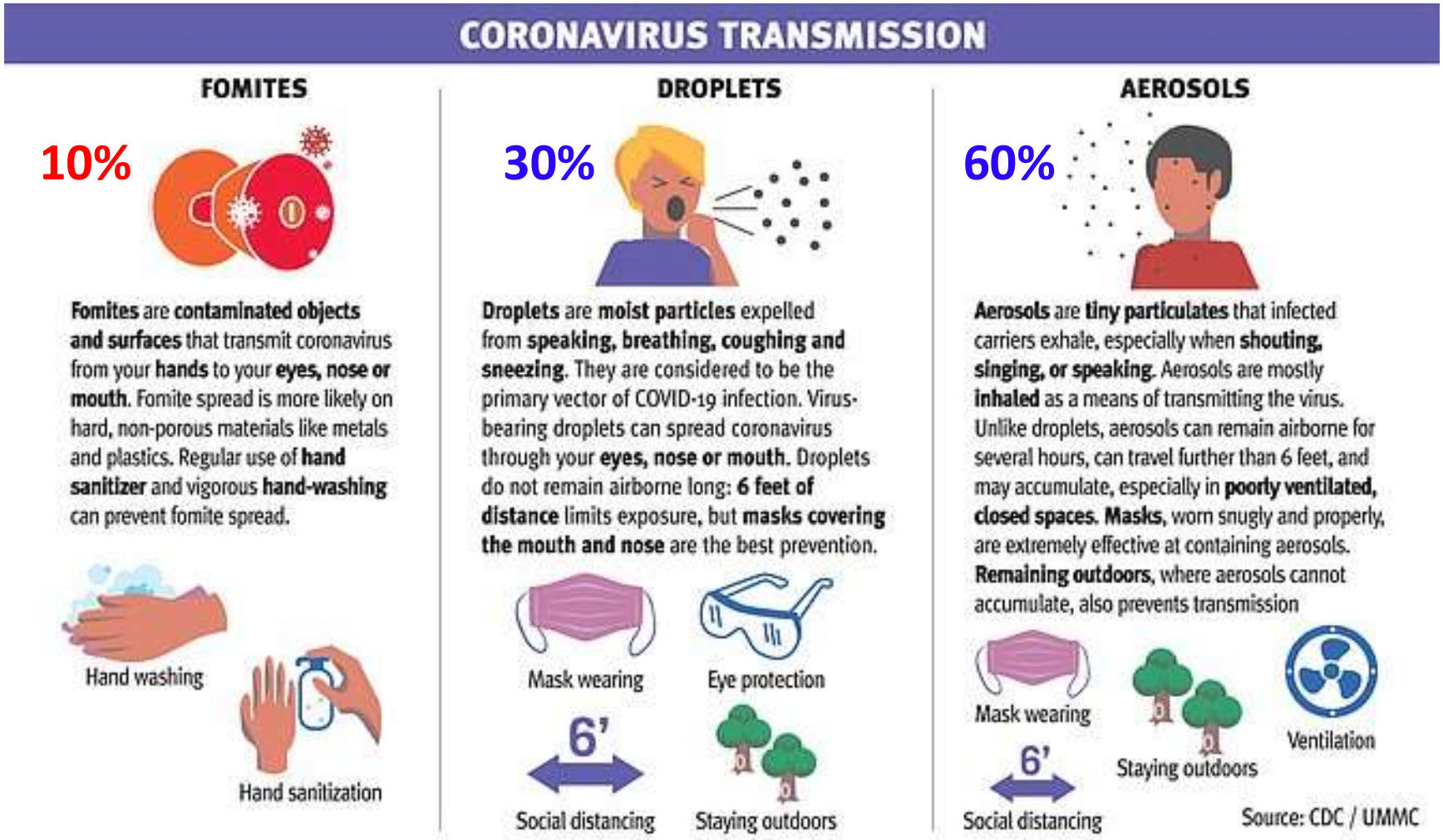
Effective COVID-19 prevention measures based on scientific studies (what works)

High costs of not following scientific recommendations leading to uncertainty and diversity of regulations for COVID-19 prevention

Myths about COVID-19 and prevention measures with limited or no effectiveness (which is useless, but gives people confidence)

Myths about COVID-19

Myth 1. COVID-19 is transmitted mainly by touching contaminated surfaces.



Myths about COVID-19

Fact: Less than 10% of infections are from contact with contaminated surfaces.

Myths about COVID-19

Myth 2. The best disinfection is achieved with high technology.

Myths about COVID-19

Fact: Regular manual surface disinfection is sufficient to reduce the transmission of COVID-19 through contaminated surfaces (reduction of up to 10% of total infections).

Myths about COVID-19

Myth 3. Transparent physical barriers are very effective for COVID-19 prevention.

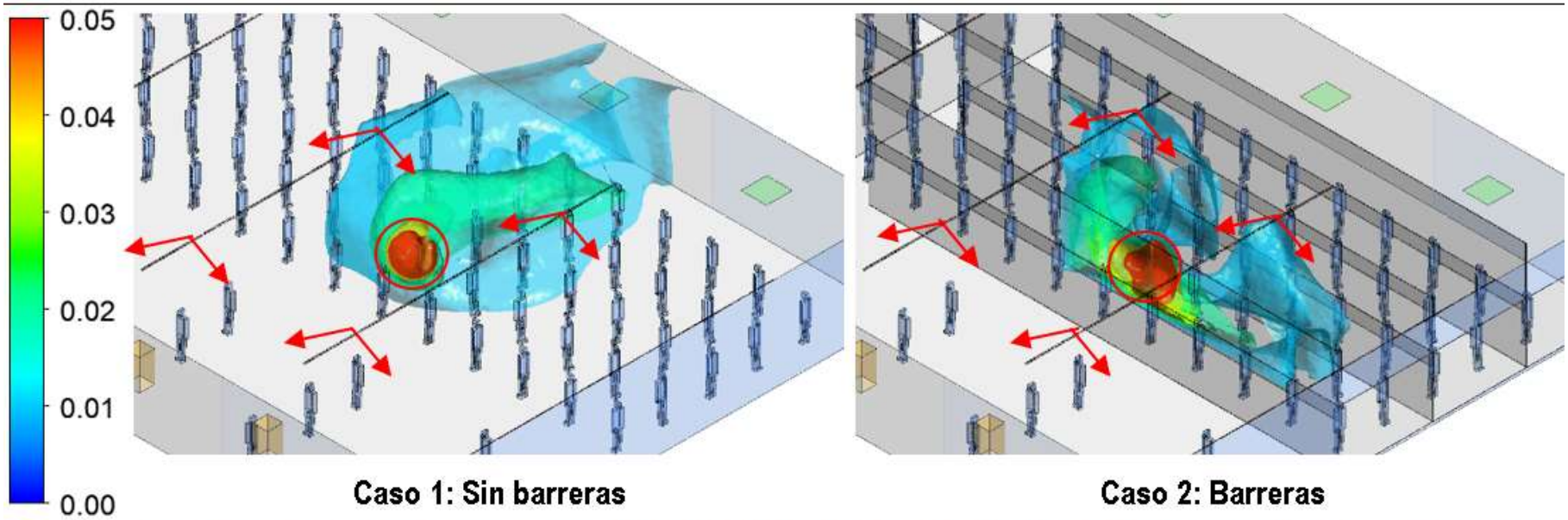
Myths about COVID-19

Reality: The effectiveness of transparent barriers is low (approximately 15%), as they only prevent large saliva droplets from falling on the face and nose, it is similar to wearing a plastic face shield.

https://www.cdc.gov/coronavirus/2019-ncov/prevent-getting-sick/cloth-face-cover-guidance.html

Myths about COVID-19

Reality: Care must be taken not to create "plastic canyons" that prevent adequate ventilation to reduce viral load (by dilution).



(1) Superficies de iso-concentración para 0,01, 0,02, 0,03, 0,04 y 0,05 cuantos/m3 (nota: para una referencia visual, el círculo rojo identifica al pasajero asintomático que libera partículas de virus, la flecha representa el aire que fluye desde la entrada/suministro de aire lineal hacia la zona ocupada).

Source: APHI Phase 2 Report. Prepared by J. Guillermo Cedeño-Laurent, ScD.

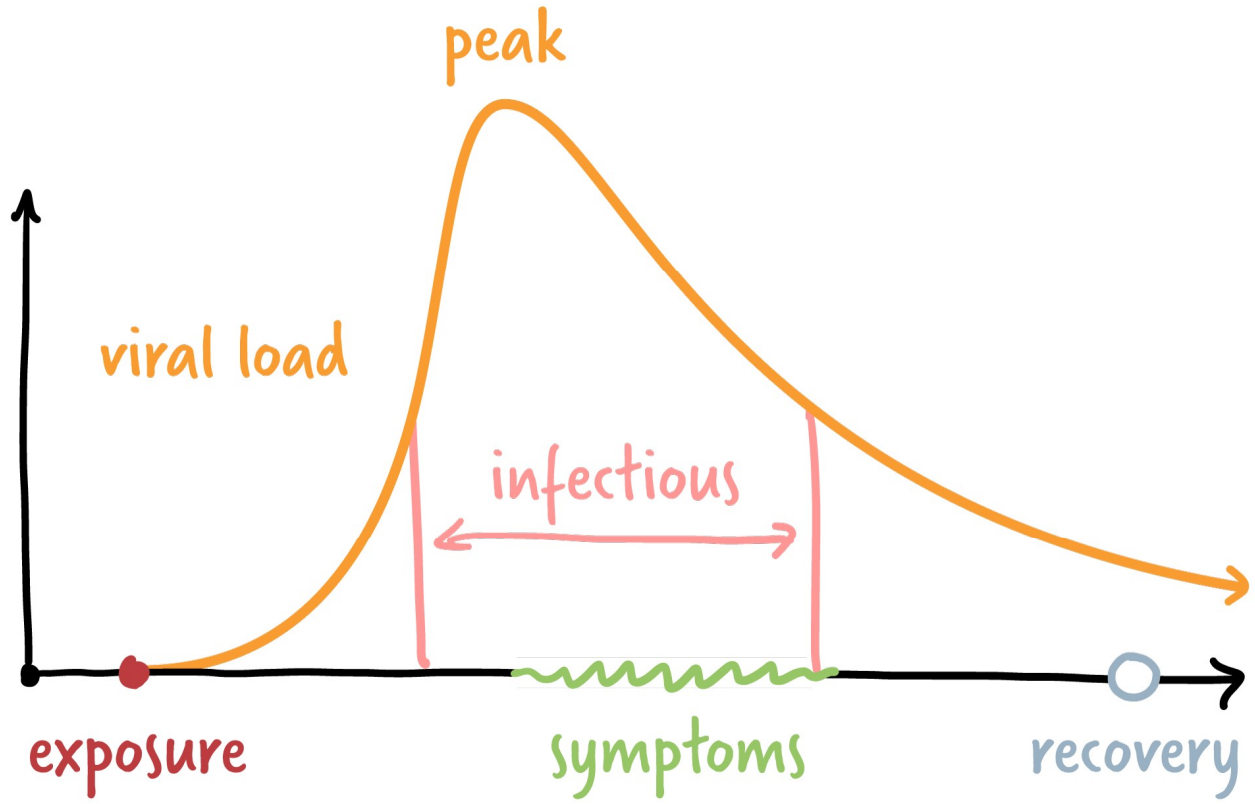
Myths about COVID-19

Myth 4. PCR testing is the best way to detect who can transmit SARS-CoV-2.

Reality: PCR tests have serious limitations as disease filters because they detect the presence of virus' genetic material, but cannot detect if the individual is infectious at this moment, thus leading to excessively severe and unnecessary measures (quarantines of several weeks, preventing non-infectious individuals from returning to productive activities, etc.).

Myths about COVID-19

The transmission period of COVID-19 ranges from 60 hours after contracting the virus to the disappearance of symptoms (peak at the end of the incubation period).



Myths about COVID-19

5. All the technologies offered by the vendors have been scientifically tested.

Fact: The effectiveness of technologies such as sanitizing mats in preventing COVID-19 has not been determined, but it is no better than using wet mats or trays and an additional mat for people to wipe their feet.

~

Myths about COVID-19

Devices that are NOT EFFECTIVE IN COMBATING COVID-19

- Ozone generators (these can even help spread the virus because they irritate the walls of the lungs and cause people to sneeze)
- Sanitizing tunnels (unlikely to kill the virus in the few seconds that the active ingredient is in contact with clothing, hands, skin, etc. Unless the dose of disinfectants is very high and harmful to health).

Photo courtesy of Times of India

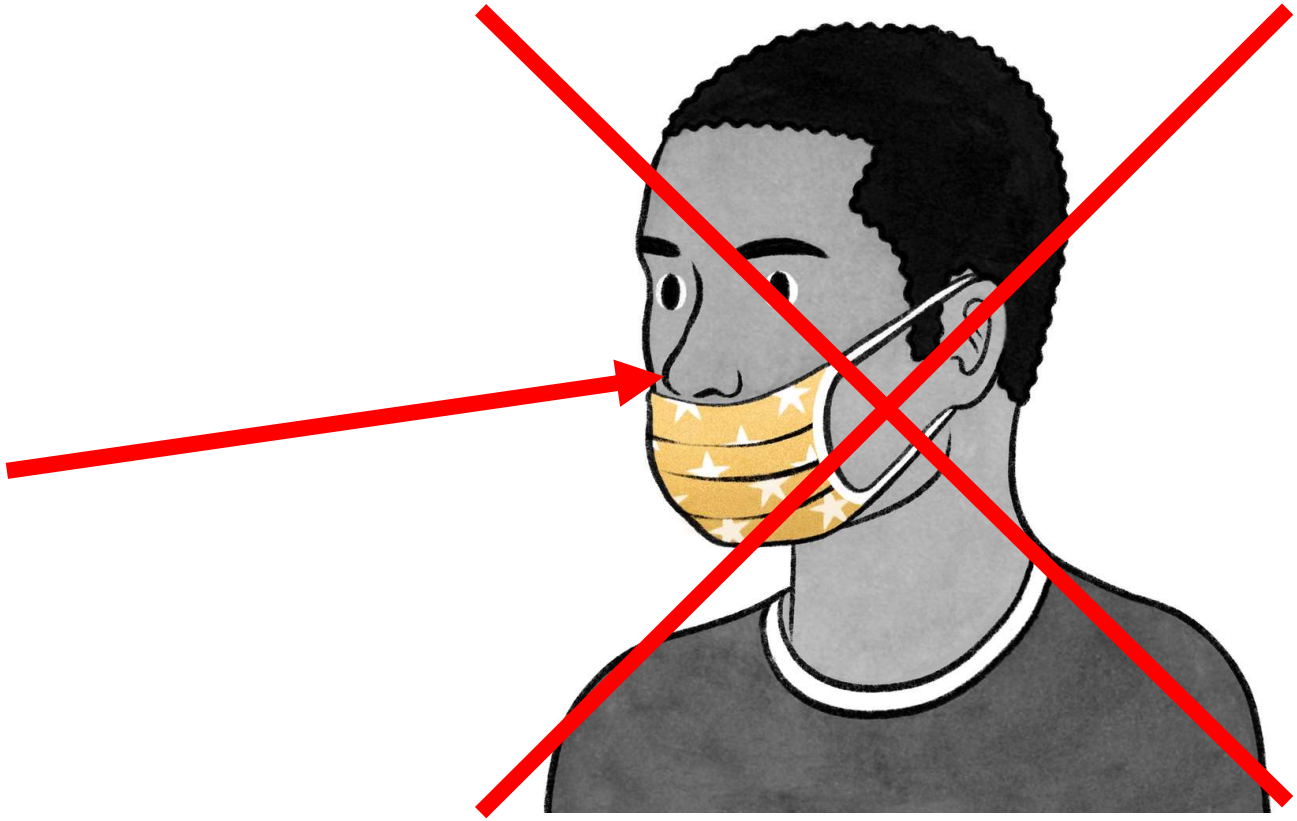
Devices that are NOT EFFECTIVE IN COMBATING COVID-19

- Fumigation with disinfectants on exterior surfaces (this is redundant, as the virus does not survive in sufficient concentration to infect).

Effective COVID-19 prevention measures based on scientific studies (what works, but what few people do)

Effective COVID-19 prevention measures

Face masks are the most effective methods to prevent inhalation of contaminated droplets and aerosols, but should cover nose and mouth.



When using a mask, **cover your mouth and nose completely. Otherwise,** exhalation of the virus continues (if infected) or you may breathe in the virus from the environment and become infected.

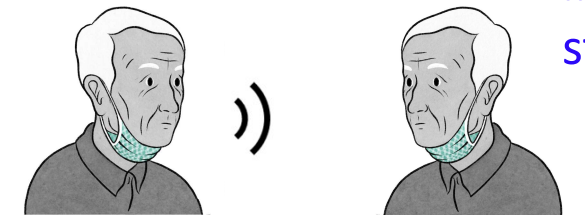
Effective COVID-19 prevention measures

Many tourist sites have requirements to wear a mask indoors, but the proper use of the mask is not checked. Only those that use discipline remain open for a long time, because there are no outbreaks.

Effective COVID-19 prevention measures

Estimated protection levels by Sanchez-Pina in May 2020 based on Leung et al, 2020; Van der Sande et al, 2008; and Davies et al, 2013.

The level of protection if everyone wears a good quality washable cotton mask is between 90 and 94%.



Level of protection for the non-infected person considering a standard cloth mask

0%

58- 74%* of viruses are not inhaled

56-78%* of viruses are not exhaled

81-94%* of viruses do not reach the healthy person.

It is assumed that a normal cloth mask (from silk to cotton blend: 60% cotton and 40% polyester) is used, not a 3-ply surgical grade mask or an N95 or KN95 respirator.

Effective COVID-19 prevention measures

Surgical-grade medical masks (3-layer) are 94-97% effective in protecting against COVID-19 even with prolonged direct exposure. But they should be kept for medical personnel.

Effective COVID-19 prevention measures

All vaccines are very effective in reducing COVID-19 transmission and mortality.

Company	Platform	Doses	Non-clinical results	# who got vaccine	Protection from hospitalization from COVID-19	Protection from COVID severe dz (some at home)	Efficacy against milder COVID
moderna	mRNA-1273 mRNA in lipid nanoparticle	2	Neutralizing Abs; Strong Th1 CD4+, CD8+; protection from challenge (macaques)	~15,000	97% (1 in vaccine arm after 2nd dose hospitalized)	97% (30 cases in placebo arm; 0 in vaccine reported but 1 severe per FDA)	94.1%
Pfizer	BNT162b2 mRNA in lipid nanoparticle	2	Neutralizing Abs; Strong Th1 CD4+, CD8+; protection from challenge (macaques)	~18,600	100%	100% (9 cases in placebo arm; 0 in vaccine- 1 initially severe but not)	95%
Johnson&Johnson	JNJ-78436725 Non-replicating human adenovirus/DNA	1	Neutralizing Abs; Strong Th1 CD4+ > Th2; CD8+; challenge protection (macaque)	~22,000 US, Latin America, S. Africa	100%	85.4% across 3 sites (7 deaths, 16 hospitalizations, all in placebo arm)	72% US; 61% Latin America; 64% S. Africa (96% B1.351)
AstraZeneca	AZD 1222 Non-replicating Chimp Adenovirus-DNA	2	Neutralizing Abs; Strong Th1 CD4+ > Th2; CD8+; protection from challenge (macaques)	~8588	100%	100% (15 in placebo – all hospitalized; 0 in vaccine)	70% overall; 76% 1 dose; S. Africa trial halted for mild
NOVAVAX	NVX-CoV2373 Spike protein/RBD + Matrix M adjuvant	2	Neutralizing Abs; Strong Th1 CD4 > Th2; challenge protection (macaques)	~8833 (Phase 3 UK; 2b SA)	100%	100% (10 severe in placebo in UK/SA; 0 in vaccine)	96.4% UK; 89% B117 UK; 55% SA (94% B1351)
Sputnik V	Ad26 and Ad5 adenovirus/DNA	2	NAbs; IFN-γ secretion PMBCs, cellular response	~14964	100%	100% (20 in placebo; 0 vaccine)	91.6%

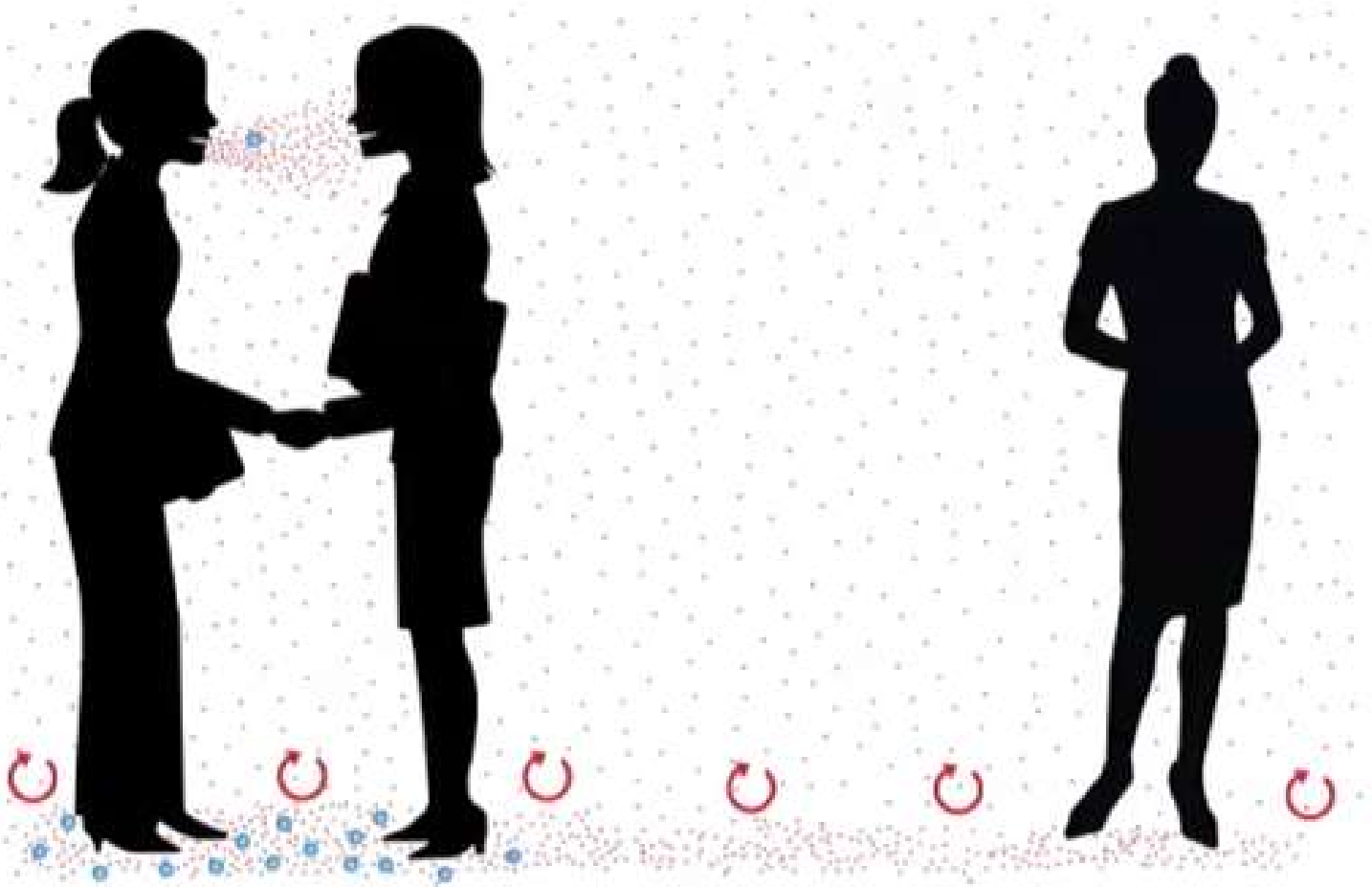
Source: Dr Monica Gandhi, 2021

Effective COVID-19 prevention measures

Indoor ventilation is essential to reduce exposure to the virus. Without outdoor ventilation (closed windows and doors), the virus can remain airborne for approximately 4 hours. In this case, the social distance of 2 meters may be insufficient if the room is moderately occupied by people not wearing masks.

Sources: Van Doremalen et al (2020); Wang Zhou (2020).

Effective COVID-19 prevention measures



Source: Khare & Marr, 2015

Effective COVID-19 prevention measures

If the room is ventilated, the risk of infection decreases.

Ventilation conditions	Average air flow	Risk reduction (compared to no ventilation)
No ventilation (doors and windows closed)	**2.3 liters/second**	**0%**
Open windows only	**7.5 liters/second**	**69.3%**
Open only the doors	**3.6 liters/second**	**36.1%**
Open doors and windows	**8.8 liters/second**	**73.8%**
Assisted mechanical ventilation with external air exchange (no virus filters of any kind)	**12 liters/second**	**80.8%**

Source: Zhu et al, 2020 (Environment International).

Effective COVID-19 prevention measures

Outdoor ventilation reduces the viral load by 90 to 95% (depending on wind speed). In any case, masks should be worn when people are near (3 meters or less).

https://www.forbes.com/sites/jvchamary/2020/06/30/face-mask-outdoors-coronavirus/?sh=5b46a2cf1822

Effective COVID-19 prevention measures

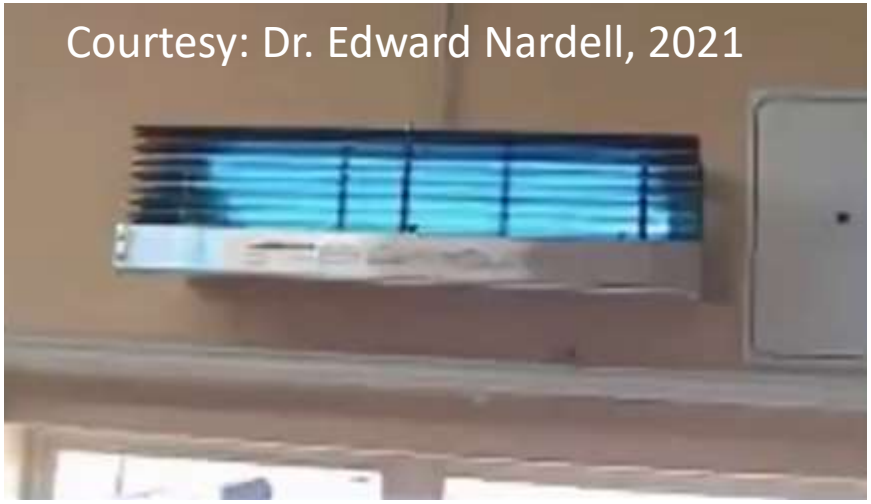
The addition of a high-efficiency portable air filter in the room could further reduce the risk. A good HEPA filter can trap 95-99% of virus-containing particles.

HEPA is a type of air filter that traps harmful particles such as pollen, pet dander, dust mites, most microorganisms and tobacco smoke. It is particularly effective where the space cannot be ventilated.

Sources: Lee and Zhu, 2014; Lee, Fung, and Zhu, 2015.

Effective COVID-19 prevention measures

Ultraviolet light with a spectrum of 254 nm is very effective in destroying the genetic material of viruses and bacteria in the air (between 95 and 99%).



Effective COVID-19 prevention measures

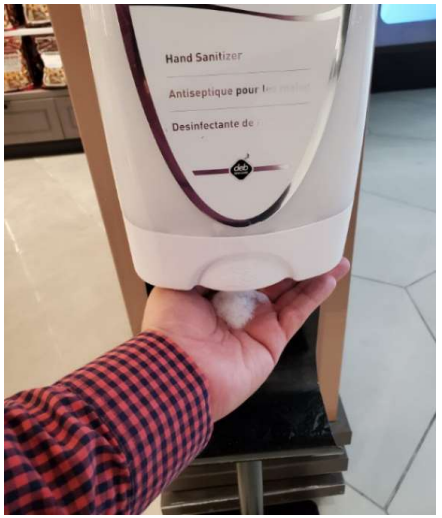
In buildings, signals spaced every 2 meters apart are used to help people maintain a sufficient distance to drastically reduce the likelihood of transmission by close contact. This is especially important while standing in line at a store or at the security checkpoint when entering a building. Safety distance signage is usually printed on the floor or on labels attached to chairs, walls, tables, poles, aisles or any other area where there is likely to be foot traffic and queuing.

Effective COVID-19 prevention measures

As signaling increases the distance between individuals, it prevents infections by infected droplets and aerosols, so its effectiveness has not been determined, but could be between 15 and 30%.

Effective COVID-19 prevention measures

Hand washing is essential, as it eliminates 99% of the virus in less than 1 minute. Disinfectant gels with an ethanol content greater than 60% are equally effective. However, if you cannot wash or disinfect your hands frequently, do not touch your face to avoid infection.



Effective COVID-19 prevention measures

Manual disinfection must be frequent, constant and thorough, as more than 50% of infected individuals are asymptomatic or have mild symptoms and are unaware that they are carriers and potentially spreaders of the virus (Ferretti et al., 2020; Prather et al., 2020, Sommerstein et al., 2020).

Effective COVID-19 prevention measures

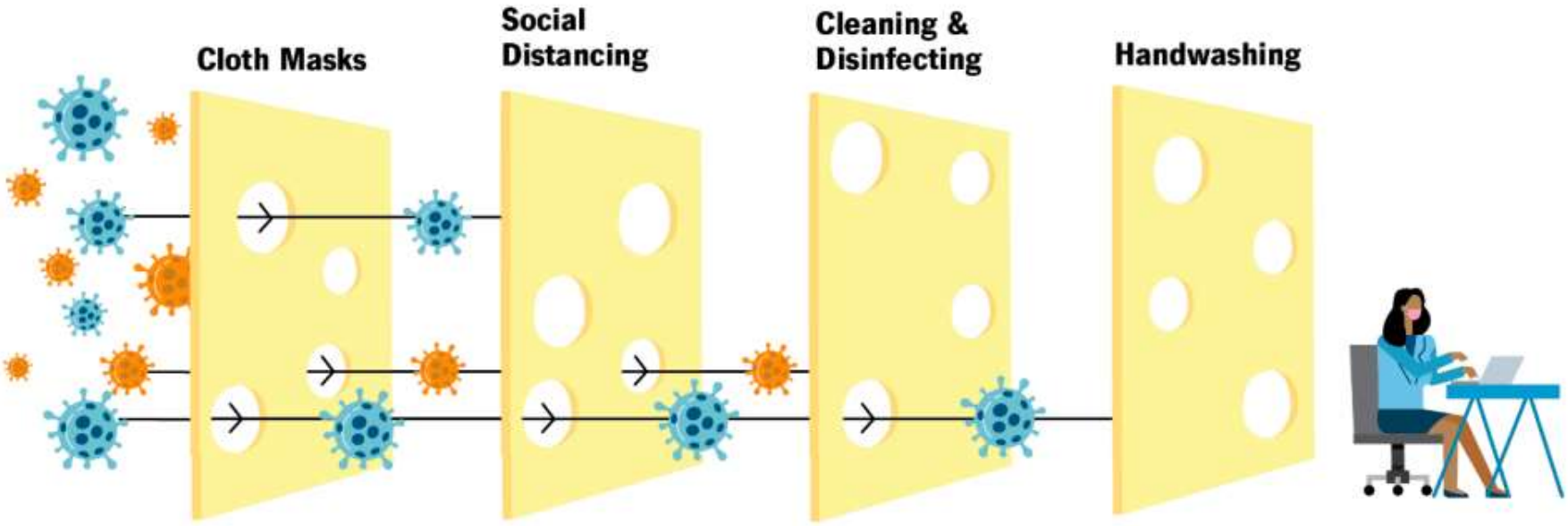
Medium	Time until virus is no longer viable (hours)	Half-life (hours)
Indoor air without ventilation	3 hours	1 hour
Stainless steel	72 hours	6 hours
Copper	4 hours	1 hour
Smooth plastic	72 hours	7 hours
Cardboard	24 hours	4 hours

Sources: APHI Phase I Report, 2020; Van Doremalen et al., 2020.

The high costs of not following scientific recommendations lead to uncertainty and diversity of regulations for COVID-19 prevention in the tourism sector. A layered approach to COVID-19 prevention defined by each productive community is required.

The layered approach to prevent COVID-19

The concept of the layered approach to risk mitigation of COVID-19



Courtesy of Cleveland Clinic, 2021

The layered approach to prevent COVID-19

Main layers for COVID-19 prevention

- Face masks and respirators
- Increased ventilation
- Signaling and promotion of social distance
- Hand hygiene
- Surface disinfection methods
- Particulate filters (portable or central)
- Air disinfection methods
- Screening methods and tests
- Transparent physical barriers

The layered approach to prevent COVID-19

The options for each layer define the level of protection.

Type of Space	Room with medium height ceiling (8 to 14 ft)	
SARS-CoV-2 strain	Original SARS-CoV-2 (no major mutations)	
Number of individuals under analysis	60	
Level of intervention	**COVID-19 area of intervention**	**Contribution to overall protection**
Self-health screening attestation	Self-health attestation at home when checking-in	20.62%
No symptom screening	Symptom screening	0.00%
No	COVID-19 testing	0.00%
All people wear non-surgical cloth masks all the time (from silk to cotton mix)	Personal protection (e.g. face masks)	69.46%
Enhanced surface disinfection with EPA Cleaning Agents	face disinfection	1.49%
	ntilation	6.75%
	ters for air disinfection	0.61%
control technologies	Signaling and crowd control	0.22%
Physical barriers (plexiglass or glass)	Physical barriers (e.g. plexiglass)	0.12%
Touchless technologies	Touchless technologies	0.08%
Antimicrobial coatings and materials	Antimicrobial Coatings and materials	0.08%
		Average
	Overall protection due to current COVID-19 prevention controls	**99.42%**

UVC on surfaces
Electrostatic spraying of disinfectants
Enhanced surface disinfection with EPA Cleaning Agents
Regular surface disinfection with EPA Cleaners
Poor surface disinfection
No surface disinfection

The layered approach to prevent COVID-19

- Educate many people about how COVID-19 infections occur and how to prevent them.
- Ask groups of people with similar activities to assess their particular risks and let them decide how to prevent COVID-19 with feasible actions accepted by the whole group.
- Provide tools for making science-based risk reduction estimates that are understandable to all.
- Governments should let the informed community discuss their needs and suggestions for preventing COVID-19 before issuing orders.

Questions?

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For some scientific reports related to COVID-19 risk reduction, visit:
https://npli.sph.harvard.edu/resources-2/aviation-public-health-initiative-aphi/