COVID - 19 and healthcare environmental hygiene

Prof. Didier Pittet

Chair, Clean Hospitals

Infection Control Programme and WHO Collaborating Center on Patient Safety,
University of Geneva Hospitals and Faculty of Medicine, Geneva, Switzerland

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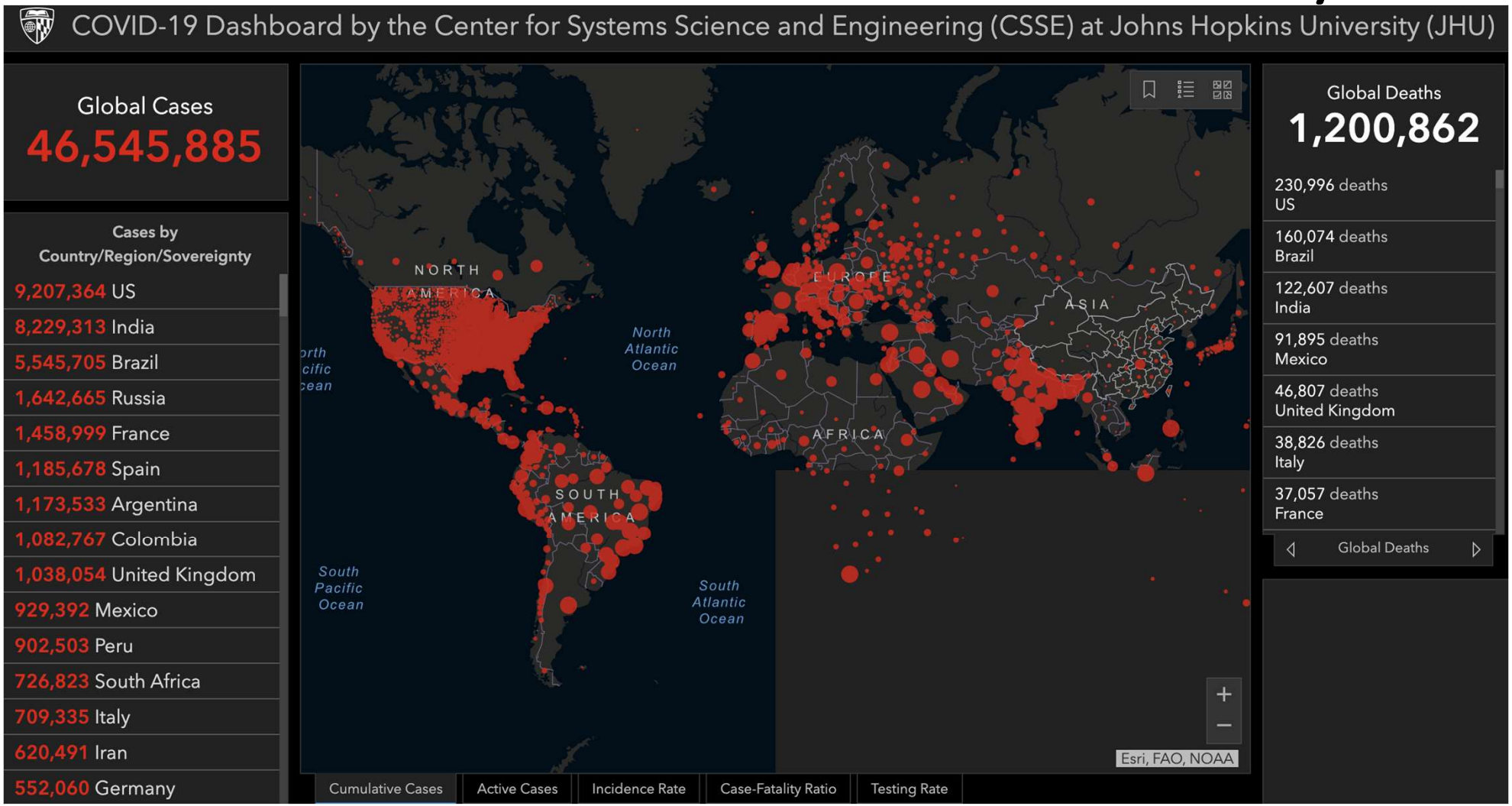
November 4th, 2020

Overview: Cases and Morbidity

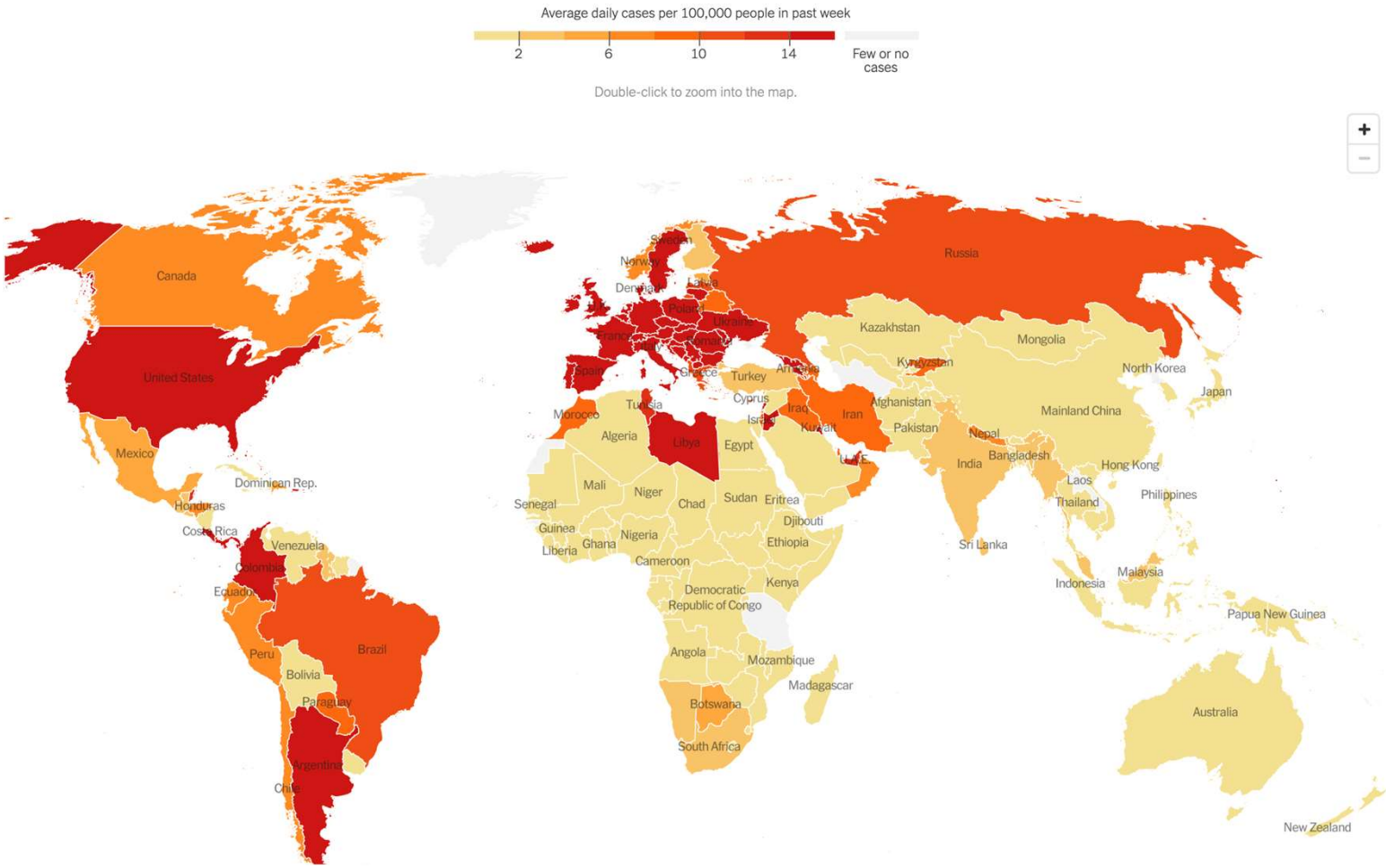
November 2, 2020



https://gisanddata.maps.arcgis.com/apps/opsdashboard/index.html#/bda7594740fd40299423467b48e9ecf6

November 2, 2020

COVID-19 prevalence by country



https://www.nytimes.com/interactive/2020/world/coronavirus-maps.html Oct 30, 2020

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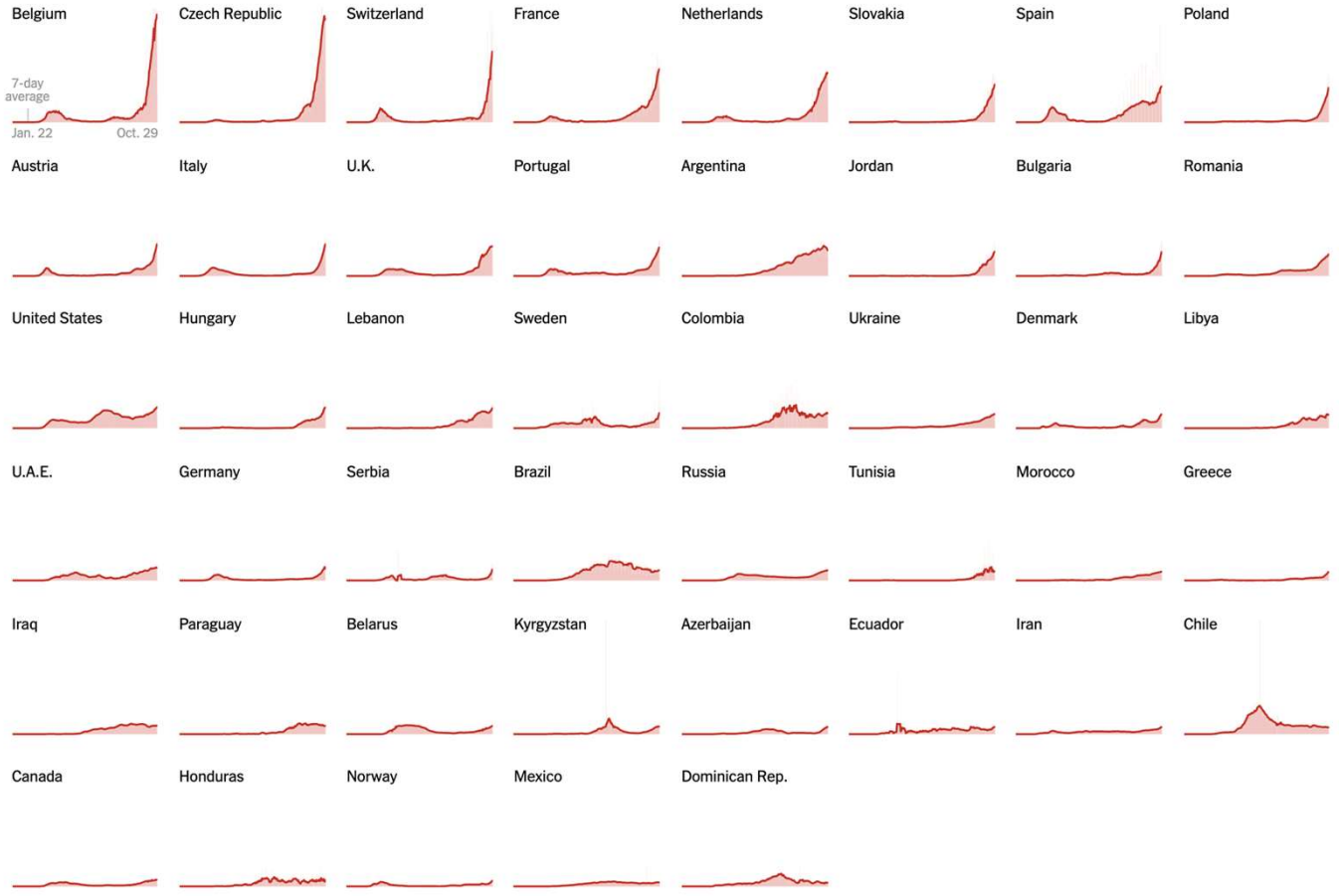
Countries with the biggest increase in new cases



https://www.nytimes.com/interactive/2020/world/coronavirus-maps.html Oct 30, 2020

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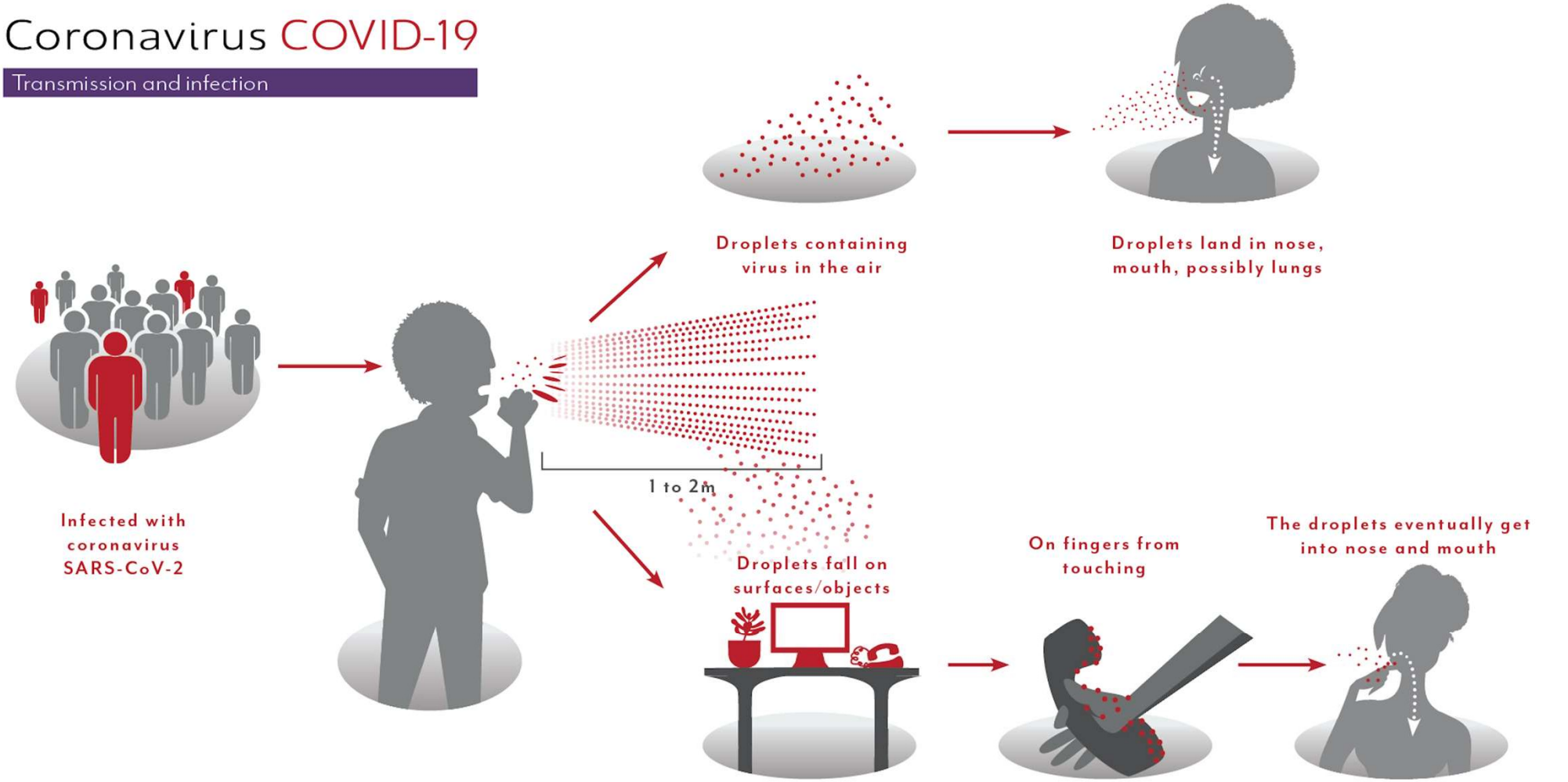
Coronavirus COVID-19

Transmission and infection



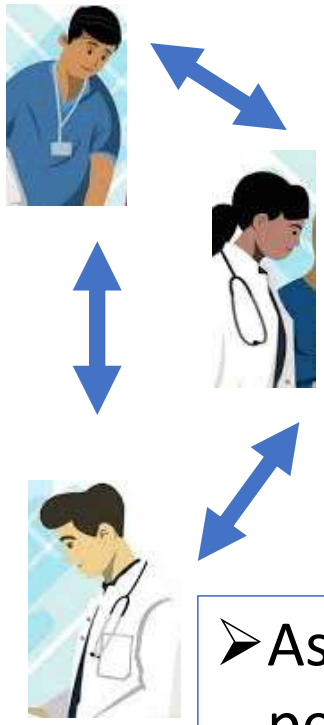
WORLD HEART FEDERATION

UNIVERSITY OF CAPE TOWN

https://www.world-heart-federation.org/resources/covid-19-transmission/

Transmission patterns among health workers

COVID patients

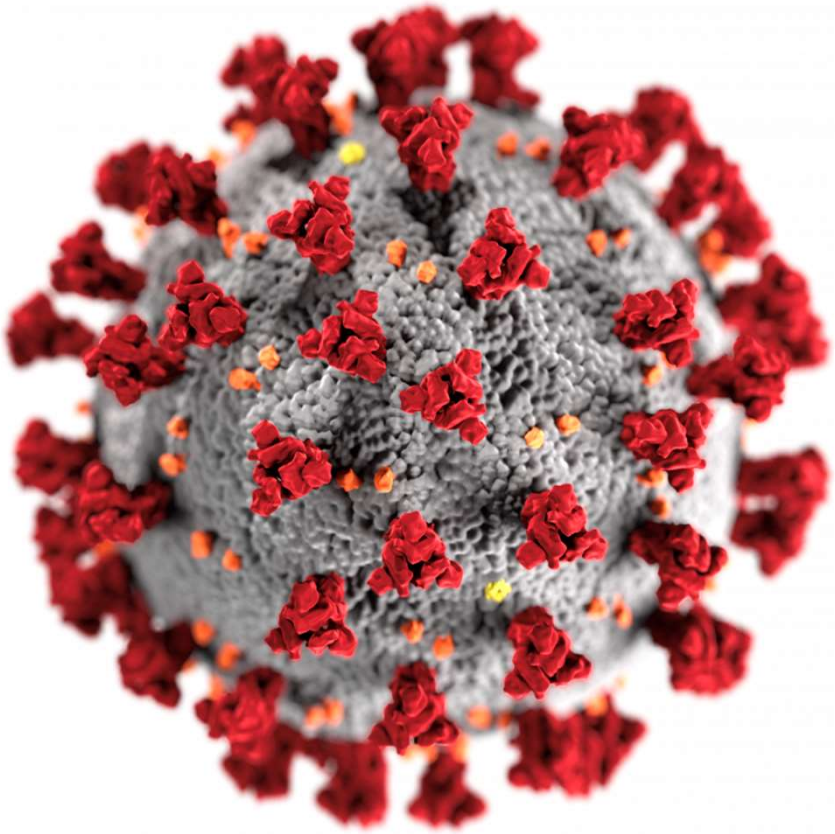


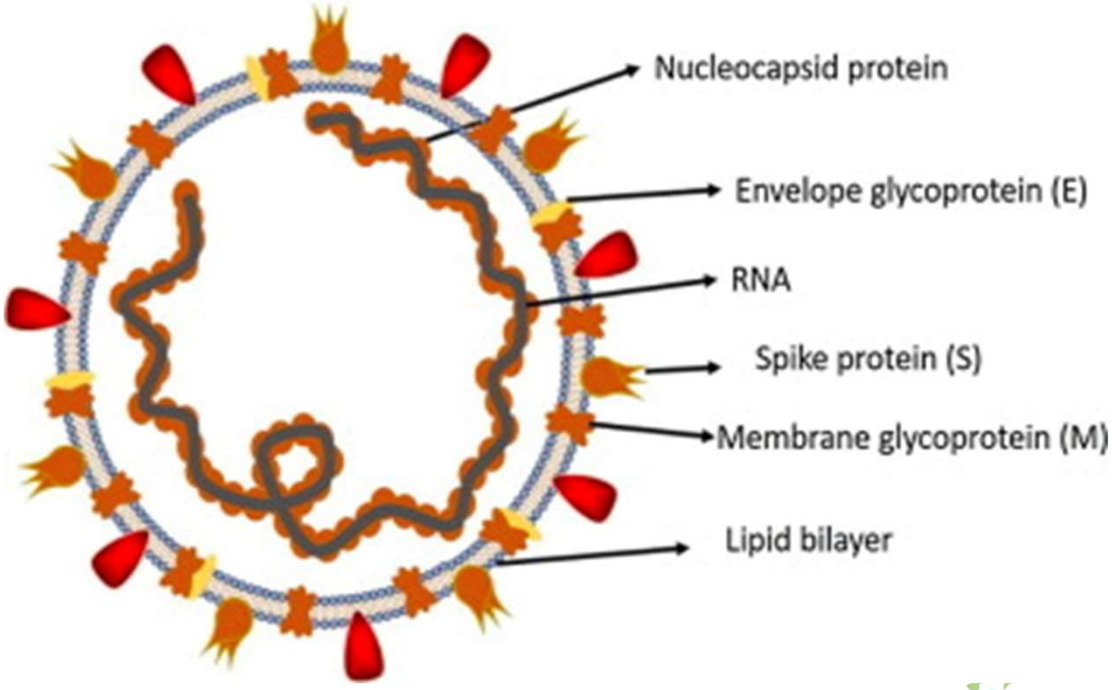
Community

Non COVID patients

- Assuming availability and adherence to personal protective equipment (PPE), the risk of infection among health workers might depend primarily on **community circulation of the virus**

The structure of encapsulated viruses: They are quite easy to kill!





https://www.sciencedirect.com/science/article/pii/S2090123220300540#f0005

SARS Cov-2 in the environment: the Literature

Zhou et al.: Looked at contamination of air and surfaces in an acute care setting in London at the peak of the first wave

- Viral RNA was detected on 114/218 (52.3%) of surfaces and 14/31 (38.7%) of air 48 samples
- But no virus was cultured

Songjie et al.: Looked at environmental detection in a COVID hospital in Wuhan

- No air contamination was detected
- Frequent surface contamination (24%-50% depending on surface)

https://www.medrxiv.org/content/10.1101/2020.05.24.20110346v2.full.pdf
https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7214329/

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SARS Cov-2 in the environment (cont.)

Ye et al.: Looked at contamination of surfaces in a hospital in Wuhan

- Frequent surface contamination (15.4%-31.9% depending on surface)
- Contaminated surfaces included COVID-19 patient care areas, hospital objects, and PPE

Doremalen et al.: Looked at environmental survival and air survival

- Tested aerosolization (by machine) in a Goldberg drum, 3hr survival (and then stopped study)
- SARS-CoV-2 was more stable on plastic and stainless steel than on copper and cardboard

https://www.sciencedirect.com/science/article/pii/S0163445320302607?casa_token=bjv-koy6CScAAAAA:OHJdV2UigcEBwJtbKbjeXlTuqzsC3Z2qi-ylAJB7qj0fFfTMMeOLAYskCE-S9ofQ3IcEkeUWUg
https://www.nejm.org/doi/full/10.1056/nejmc2004973

SARS Cov-2 in the environment (cont.)

Jiang et al.: Looked at contamination of surfaces and air in a hospital in Changchun, China

- The positive rates of the air and surfaces (150 samples) were 3.57% (1/28) and 0.77% (1/130), respectively
- Used ultraviolet air filtering and 1000-2000 mg/L chlorine-containing disinfectant for ambient air and floor disinfection

Chin et al: Tested the survivability of SARS Cov-2 on a variety of surfaces

- RNA was still recovered after several days on a number of surfaces (no culture)

https://www.medrxiv.org/content/10.1101/2020.02.25.20028043v2.full.pdf+html
https://www.thelancet.com/journals/lanmic/article/PIIS2666-5247(20)30003-3/fulltext

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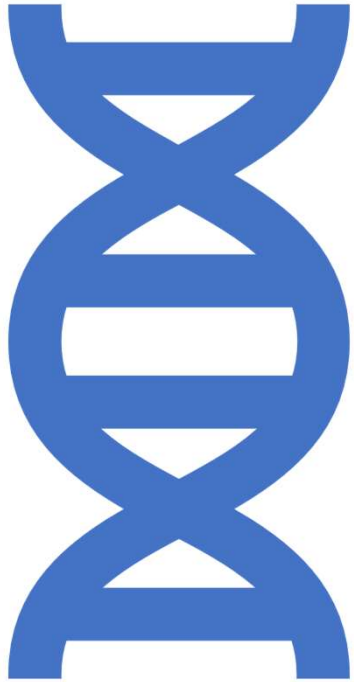
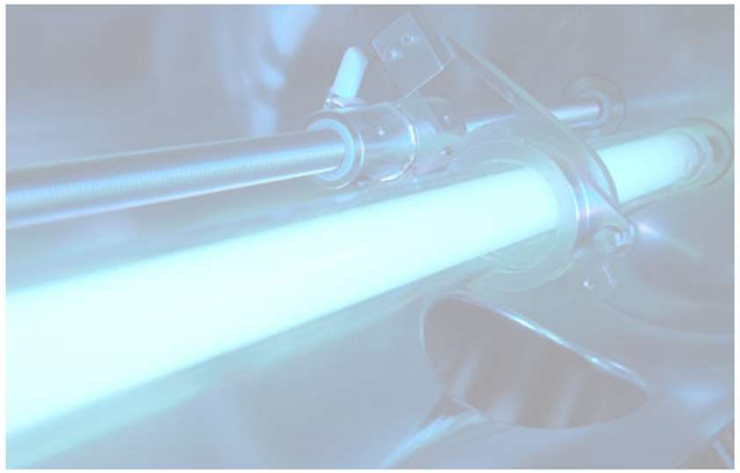
What does this all mean?

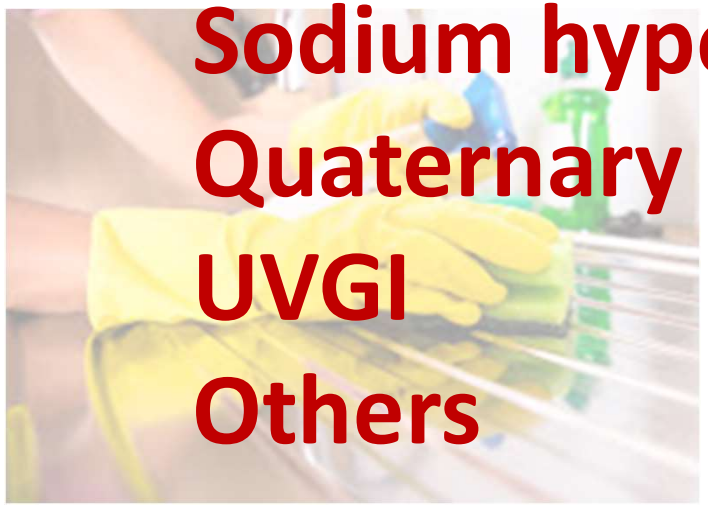
- Viral RNA is often on surfaces, and we know it can stay there for a long time
- It is possible to keep aerosolized SARS Cov-2 suspended in the air for a long time in controlled experimental conditions
- Disinfection procedures drastically lower the viral RNA recovered from the environment
- It is difficult to culture viable viruses from the environment



MANY types of products kill SARS CoV-2:

Heat/ Steam
Detergents
Alcohol
Sodium hypochlorite
Quaternary ammonium
UVGI
Others





EPA Tool:

Can browse products

or

Can search by:

Ingredient
Registration #
Environment type
(ex. healthcare)
Contact time

https://cfpub.epa.gov/giwiz/disinfectants/index.cfm

The aerosolization debate:

- R_0 for SARS CoV-2 vs. other airborne viruses
- The technical vs. the clinically urgent
- The WHO and the CDC perspectives

J Hosp Infect. 2020 Apr 30

doi: 10.1016/j.jhin.2020.04.040 [Epub ahead of print]

PMCID: PMC7190524

PMID: 32360356

Putting some context to the aerosolization debate around SARS-CoV-2

A. Peters,[a] P. Parneix,[b] J. Otter,[c] and D. Pittet[a,*]

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Sir,

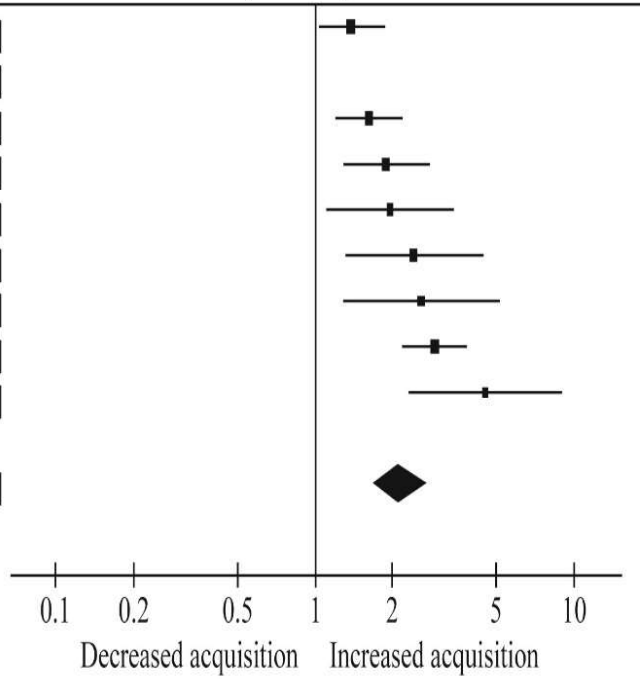
A letter entitled ‘Aerosol and surface stability of SARS-CoV-2 as compared with SARS-CoV-1’ was published recently in the *New England Journal of Medicine* [1]. The experiments reported in this letter compared the stability of SARS-CoV-2 and SARS-CoV-1 in aerosols and on a number of different

The importance of a clean hospital room: Risk of acquisition from prior room occupants by organism

Study or Subgroup	Decreased acquisition Events	Total	Control Events	Total	Weight	Odds Ratio M-H, Random, 95% CI
Huang (MRSA)	57	1454	248	8697	16.2%	1.39 [1.04, 1.86]
Nseir (ESBL producing Gram neg)	8	50	50	461	0.0%	1.57 [0.70, 3.52]
Huang (VRE)	58	1291	256	9058	16.2%	1.62 [1.21, 2.16]
Ajao (Klebsiella sp. or Escherichia coli)	32	648	235	8723	14.2%	1.88 [1.29, 2.74]
Nseir (Pseudomonas)	21	85	61	426	10.4%	1.96 [1.12, 3.45]
Drees (VRE)	19	138	31	500	9.7%	2.42 [1.32, 4.43]
Shaughnessy (Clostridium difficile)	10	91	77	1679	8.3%	2.57 [1.28, 5.15]
Mitchell (MRSA)	74	884	163	5344	16.4%	2.90 [2.18, 3.86]
Nseir (Acinetobacter)	16	52	41	459	8.6%	4.53 [2.32, 8.86]
Total (95% CI)		4643		34886	100.0%	2.14 [1.65, 2.77]
Total events	287		1112			

Heterogeneity: $Tau^2 = 0.09$; $Chi^2 = 21.32$, df = 7 (P = 0.003); $I^2 = 67\%$

Test for overall effect: Z = 5.74 (P < 0.00001)



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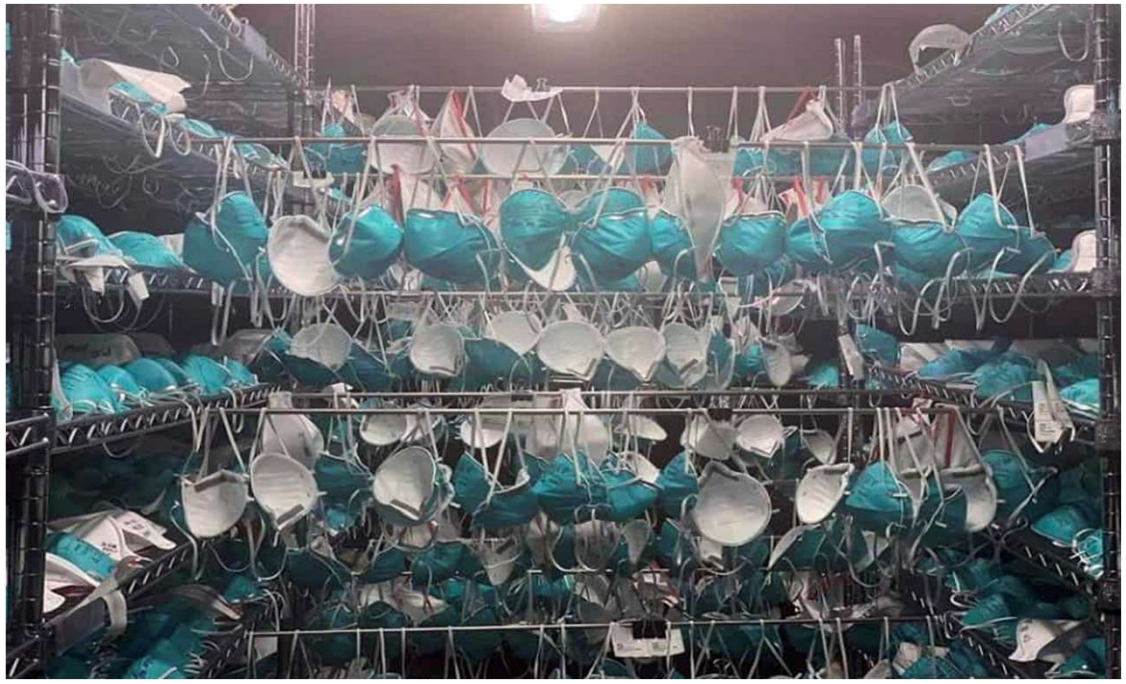
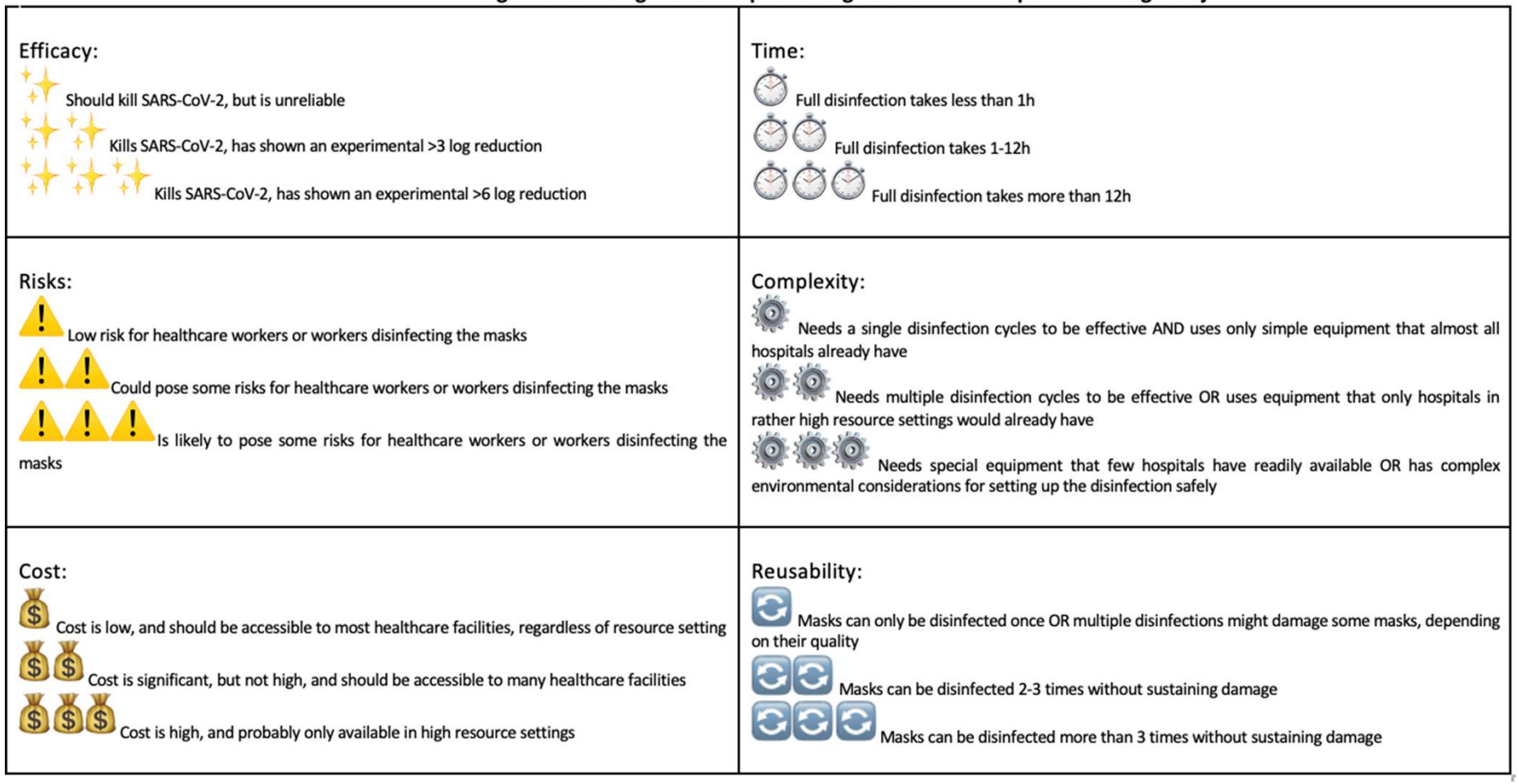
Mitchell, B. G., Dancer, S. J., Anderson, M. & Dehn, E. Risk of organism acquisition from prior room occupants: a systematic review and meta-analysis. *J. Hosp. Infect.* 91, 211–217 (2015).

Reusing disposables and local production



Making it easier for hospitals to decide:

Figure 1: Visual guide for reprocessing and reuse of respirators using emojis



Peters, et al. Article in submission.

Results of the systematic review :

Method	# Studies	Type of pathogen	Microbiological result	Integrity, fit and filtration
Benzalkonium Chloride wipes[30]	1	Bacteria	Disinfection	Failed
Dry Heat[35,38-42,61,74,79,]	9	Viruses and Bacteria	Disinfection and failure	6 studies: all passed
Ethanol[35,40,48]	3	Viruses and spore-forming bacteria	Disinfection and failure	Failed
Ethylene oxide[79,20]	2	Viruses	Sterilization and disinfection	2 studies: all passed
Gaseous hydrogen peroxide[20,40,42,47,48,49,51,79,80]	11	Viruses, bacteria, spore-forming bacteria, fungus	Sterilization, disinfection, 1 failure	9 studies: all passed
Gaseous hydrogen peroxide with peracetic acid[74,81]	2	Viruses, bacteria and spore-forming bacteria	Sterilization	1 study: passed
Hypochlorite[30,35]	2	Bacteria and spore-forming bacteria	Disinfection	1 study: failed
Moist heat[39,47,57-59,60,61,79,]	8	Viruses, Bacteria, spore-forming bacteria	Sterilization, disinfection, failure	5 studies: passed

Peters, et al. Article in submission.

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Results of the systematic review (cont.):

Microwave-generated moist heat [23,24, 58-60]	5	Viruses and Bacteria	Disinfection	3 studies: passed, 1 study: mixed results
Non-antimicrobial detergent wipes[30]	1	Bacteria	Failure	Failure
Ozone [26,62,63]	3	Viruses and Bacteria	Sterilization, disinfection, 1 failure	3 studies: 2 failed elastic band but passed face piece, 1 study: passed
Peracetic acid dry fogging system (PAF)[20]	1	Viruses	Sterilization and disinfection	Passed
Steam[20,35,66,]	3	Viruses, bacteria and spore-forming bacteria	Sterilization, disinfection, failure	2 studies: passed
UVA[35]	1	spore-forming bacteria	Failure	N/A
UVGI[29,35,40,42,48,58-60,69,70,72, 74,79,82,83]	15	Viruses, bacteria, spore-forming bacteria, fungus	Sterilization, disinfection, failure	7 studies: 1 failure, 1 partial failure, 5 passed
UVGI+ dry heat[68,79]	2	Viruses and Bacteria	Disinfection and failure	Passed
UVGI+ medium humidity heat[79]	1	Viruses	Sterilization, disinfection, failure	Passed

Peters, et al. Article in submission.

The cost and value of environmental hygiene

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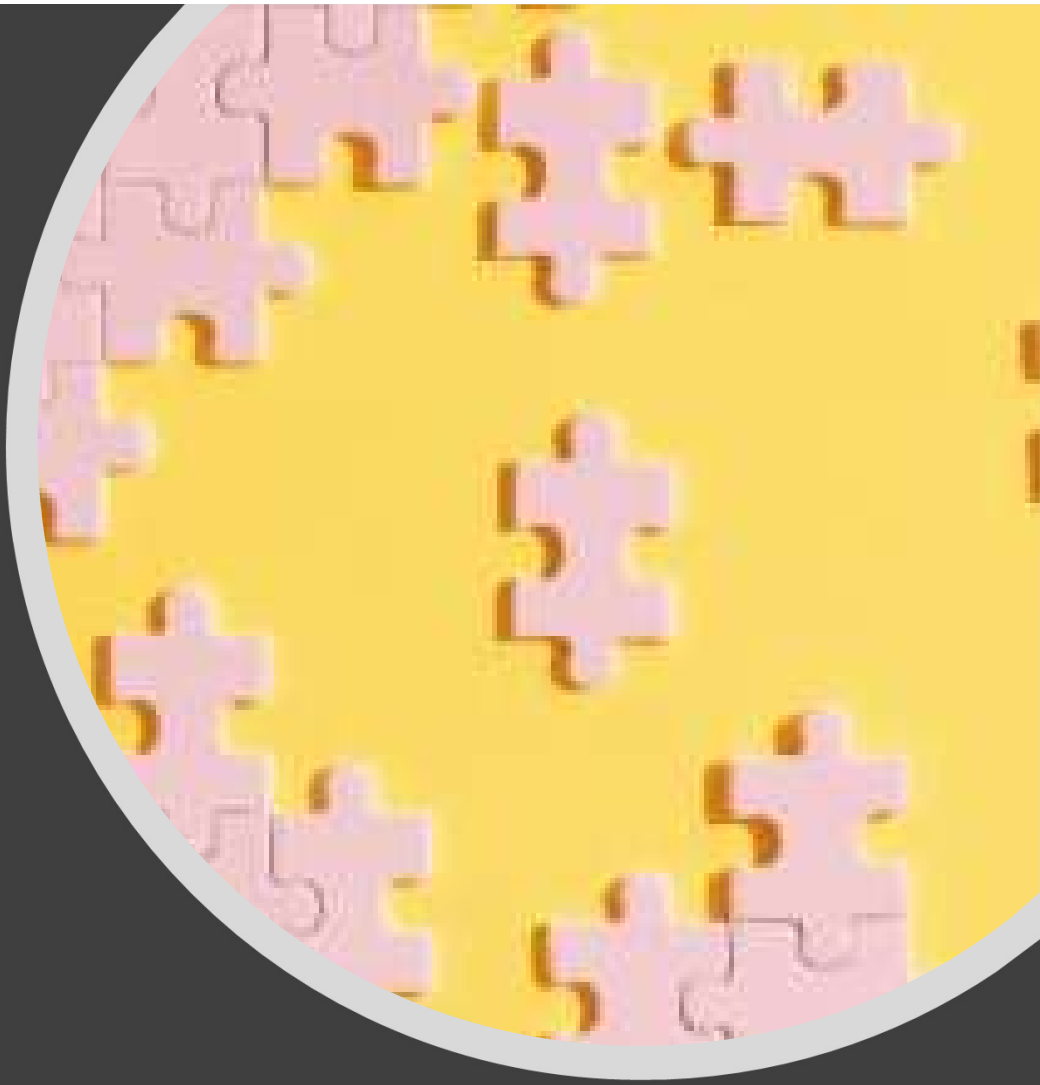
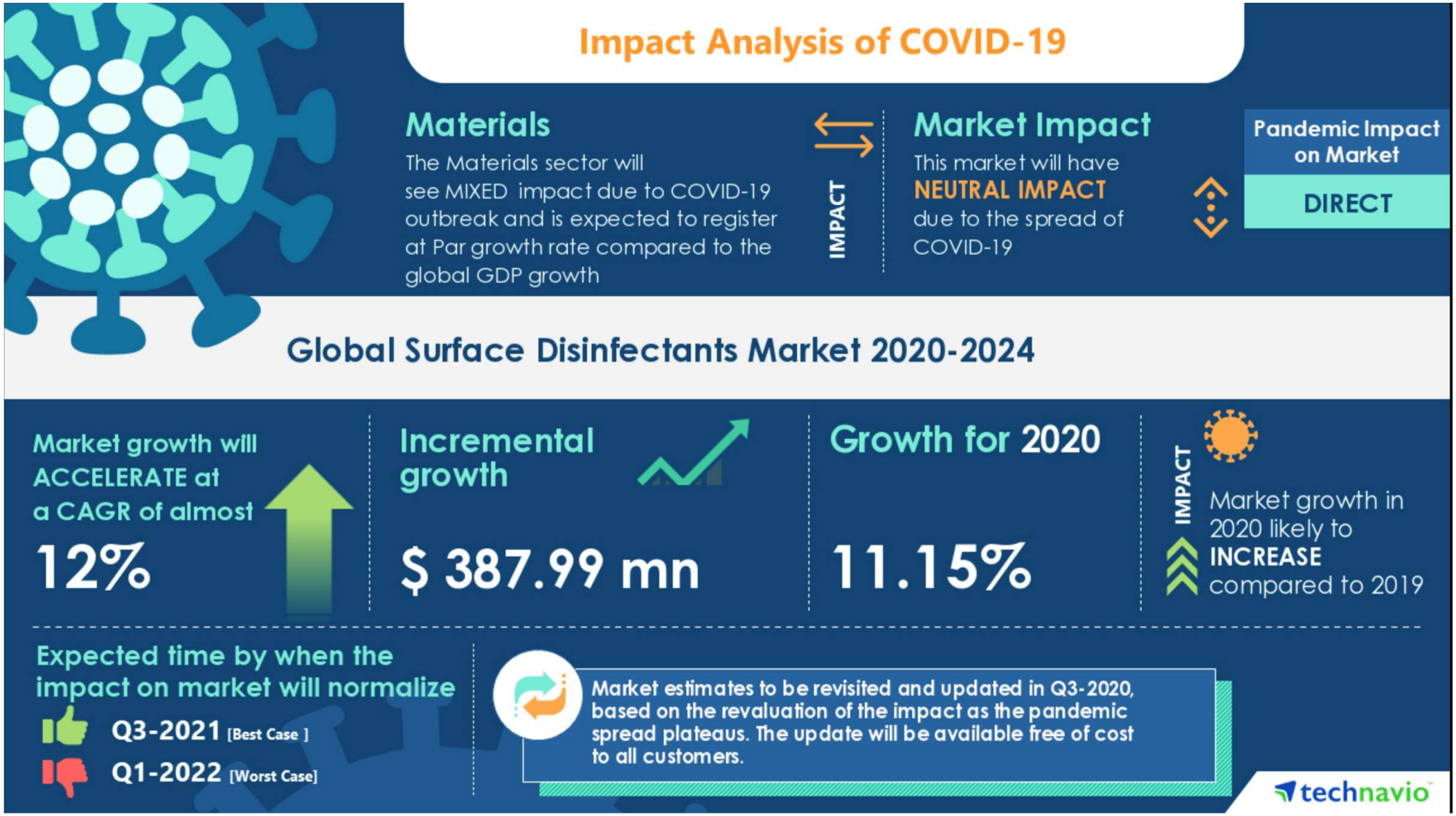
Why is it so difficult to figure out?

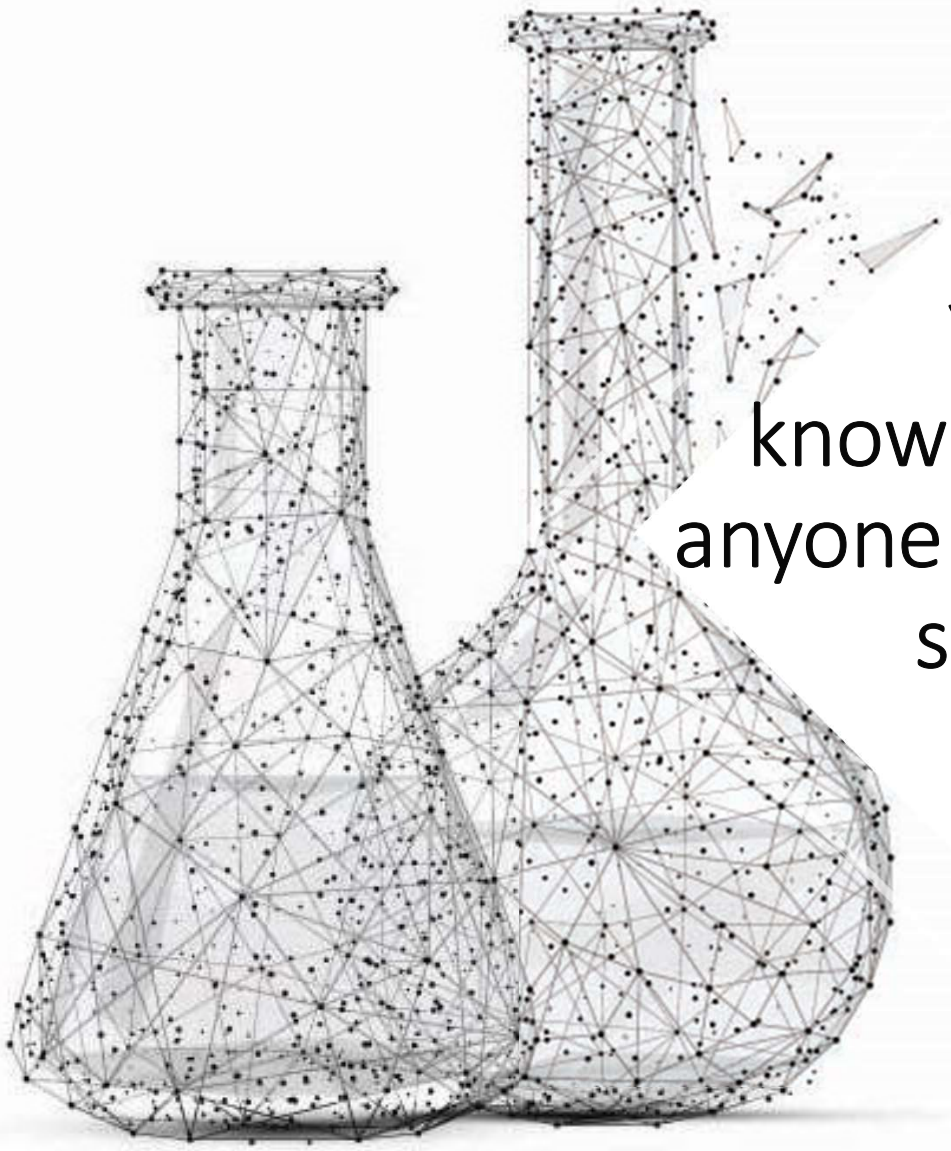
- Costs of not cleaning can affect numerous budgets within a hospital

- Need to look at both expenditures and averted expenditures (including patient days, opportunity costs, staff time, missed surgical revenue, averted infections)





Technavio, Global Surface Disinfectants Market 2020-2024. Business Wire https://www.businesswire.com/news/home/20200903005148/en/Research-Report-Surface-Disinfectants-Market-2020-2024-Increasing



You all know better than anyone - cleaning is a science!

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Cleaning vs. Disinfecting

Both reduce microbial contamination, but there is a difference in the amount of reduction

Cleaning- the process of the physical removal of dust and dirt (which also removes some microbes)

- Ex. with surfactants or scrubbing

Disinfection- process of killing microbes through mechanical or chemical means

- Ex. with heat or alcohol

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The real question is, what is the cost of NOT cleaning?

Investing in quality is worth it!

Cleaning a hospital: What makes it different from a school?

Why are hospitals different?

- Difference in vulnerability of population
- Difference in level of contamination from sick patients
- Pathogens in hospitals can differ from those in the community
- Difference in needed level of cleanliness (depending on zones)
- Range of specific environments
- Pathogen transmission patterns, host affinities, microbiological characteristics

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Conclusion:
Cleaner Hospitals mean safer hospitals!

Healthcare environmental hygiene is a key component to ensuring safety in pandemics

We need to focus on the real dangers and evidence-based best practices

We need to make sure that our interventions are safe and based in science

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