Twitter Thread by zeynep tufekci

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The WHO just updated its page on how COVID-19 transmits. Those few sentences on aerosols represent one of the most crucial scientific advances of the pandemic. My NYT piece on the century-long history of the error, the year of delay—and what it means now. https://t.co/B9y2Mf6LC7

> The revised response still emphasizes transmission in close contact but now says it may be via aerosols — smaller respiratory particles that can float — as well as droplets. It also adds a reason the virus can also be transmitted "in poorly ventilated and/or crowded indoor settings," saying this is because "aerosols remain suspended in the air or travel farther than 1 meter."
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> The change didn't get a lot of attention. There was no news conference, no big announcement.
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> But this latest shift challenges key infection control assumptions that go back a century, putting a lot of what went wrong last year in context. It may also signal one of the most important advancements in public health during this pandemic.
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> If the importance of aerosol transmission had been accepted early, we would have been told from the beginning that it was much safer outdoors, where these small particles disperse more easily, as long as you avoid close, prolonged contact with others. We would have tried to make sure indoor spaces were well ventilated, with air filtered as necessary. Instead of blanket rules on gatherings, we would have targeted conditions that can produce superspreading events: people in poorly ventilated indoor spaces, especially if engaged over time in activities that increase aerosol production, like shouting and singing. We would have started using masks more quickly, and we would have paid more attention to their fit, too. And we would have been less obsessed with cleaning surfaces.

This history goes back to scientists trying to get germ theory accepted and fighting (incorrect) folk theories of miasma—infection via stinky air—and they made some mistakes themselves along the way. Some froze into dogma. It took until this pandemic to, finally, start fixing it.

It's a huge advance, not a minor change. It explains so much of what went wrong and how to do better. We started with an incorrect theory of how COVID-19 transmits. One key error goes back a century. And it took a pandemic year to get to even this point. https://t.co/B9y2Mf6LC7

Second, she said, proximity is conducive to transmission of aerosols as well because aerosols are more concentrated near the person emitting them. In a twist of history, modern scientists have been acting like those who equated stinky air with disease, by equating close contact, a measure of distance, only with the larger droplets, a mechanism of transmission, without examination.

Since aerosols also infect at close range, measures to prevent droplet transmission — masks and distancing — can help dampen transmission for airborne diseases as well. However, this oversight led medical people to circularly assume that if such measures worked at all, droplets must have played a big role in their transmission.

Other incorrect assumptions thrived. For example, in July, right after the letter by the hundreds of scientists challenging the droplet paradigm, Reuters reported that Dr. John Conly, who chairs a key W.H.O. infection prevention working group, said that there would be many more cases if the virus was airborne and asked, "Would we not be seeing, like, literally billions of cases globally?" He made similar claims last month. And he is not the only member of that group to assert this, a common assumption in the world of infection control well into 2021.

However, Dr. Marr pointed out, there are airborne diseases, like measles, that are highly contagious and others, like tuberculosis, that are not. Moreover, while SARS-CoV-2 is certainly not as infectious as measles on average, it can be highly infectious in the superspreading events driving the pandemic.

Many respiratory viruses carried by aerosols survive better in colder environments and lower relative humidity, Dr. Marr said, again fitting the pattern of outbreaks around the world, for example, in many meatpacking plants. Plus, some activities produce more aerosols — talking, yelling, singing, exercising — also fitting the pattern of outbreaks globally.

Why did it take so long to understand all this?

It's a long piece—and honestly, maybe I have maybe 10% of just the narrative in there, and maybe 2% of the history—let alone the fascinating science. I'm co-author on this peer-reviewed piece in The Lancet that explains some scientific details/issues. https://t.co/xPnnWfo75E

Ten scientific reasons in support of airborne transmission of SARS-CoV-2

Heneghan and colleagues' systematic review, funded by WHO, published in March, 2021, as a preprint, states: "The lack of recoverable viral culture samples of SARS-CoV-2 prevents firm conclusions to be drawn about airborne transmission".[1] This conclusion, and the wide circulation of the review's findings, is concerning because of the public health implications.

If an infectious virus spreads predominantly through large respiratory droplets that fall quickly, the key control measures are reducing direct contact, cleaning surfaces, physical barriers, physical distancing, use of masks within droplet distance, respiratory hygiene, and wearing high-grade protection only for so-called aerosol-generating health-care procedures. Such policies need not distinguish between indoors and outdoors, since a gravity-driven mechanism for transmission would be similar for both settings. But if an infectious virus is mainly airborne, an individual could potentially be infected when they inhale aerosols produced when an infected person exhales, speaks, shouts, sings, sneezes, or coughs. Reducing airborne transmission of virus requires measures to avoid inhalation of infectious aerosols, including ventilation, air filtration, reducing crowding and time spent indoors, use of masks whenever indoors, attention to mask quality and fit, and higher-grade protection for health-care staff and front-line workers.[2] Airborne transmission of respiratory viruses is difficult to demonstrate directly.[3] Mixed findings from studies that seek to detect viable pathogen in air are therefore insufficient grounds for concluding that a pathogen is not airborne if the totality of scientific evidence indicates otherwise. Decades of painstaking research, which did not include capturing live pathogens in the air, showed that diseases once considered to be spread by droplets are airborne.[4] Ten streams of evidence collectively support the hypothesis that SARS-CoV-2 is transmitted primarily by the airborne route.[5]

First, superspreading events account for substantial SARS-CoV-2 transmission; indeed, such events may be the pandemic's primary drivers.[6] Detailed analyses of human behaviours and interactions, room sizes, ventilation, and other variables in choir concerts, cruise ships, slaughterhouses, care homes, and correctional facilities, among other settings, have shown patterns—eg, long-range transmission and overdispersion of the basic reproduction number (R_0), discussed below—consistent with airborne spread of SARS-CoV-2 that cannot be adequately explained by droplets or fomites.[6] The high incidence of such events strongly suggests the dominance of aerosol transmission.

Second, long-range transmission of SARS-CoV-2 between people in adjacent rooms but never in each other's presence has been documented in quarantine hotels.[7] Historically, it was possible to prove long-range transmission only in the complete absence of community transmission.[4]

Third, asymptomatic or presymptomatic transmission of SARS-CoV-2 from people who are not coughing or sneezing is likely to account for at least a third, and perhaps up to 59%, of all transmission globally and is a key way SARS-CoV-2 has spread around the world,[8] supportive of a predominantly airborne mode of transmission. Direct measurements show that speaking produces thousands of aerosol particles and few large droplets,[9] which supports the airborne route.

Fourth, transmission of SARS-CoV-2 is higher indoors than outdoors[10] and is substantially reduced by indoor ventilation.[5] Both observations support a predominantly airborne route of transmission.

Fifth, nosocomial infections have been documented in health-care organisations, where there have been strict contact-and-droplet precautions and use of personal protective equipment (PPE) designed to protect against droplet but not aerosol exposure.[11]

Sixth, viable SARS-CoV-2 has been detected in the air. In laboratory experiments, SARS-CoV-2 stayed infectious in the air for up to 3 h with a half-life of 1·1 h.[12] Viable SARS-CoV-2 was identified in air samples from rooms occupied by COVID-19 patients in the absence of aerosol-generating health-care procedures[13] and in air samples from an infected person's car.[14] Although other studies have failed to capture viable SARS-CoV-2 in air samples, this is to be expected. Sampling of airborne virus is technically challenging for several reasons, including limited effectiveness of some sampling methods for collecting fine particles, viral dehydration during collection, viral damage due to impact forces (leading

It is *really* important for the WHO, the CDC and all the public health agencies to publicize this and lead because there are also a lot of misconceptions—some stemming from the same errors. Masks and distance are still important, for example, but need more context to evaluate.

And... Wow. The New York Times is reporting that the CDC has just updated its descriptions of how COVID-19 is transmitted via aerosols. (Reading the CDC new version now). Eppure galleggia. https://t.co/8Xx0fHe8Oo

Federal health officials on Friday updated public guidance about how the coronavirus spreads, emphasizing that transmission occurs by inhaling very fine respiratory droplets and aerosolized particles, as well as through contact with sprayed droplets or touching contaminated hands to one's mouth, nose or eyes.

The Centers for Disease Control and Prevention now states explicitly — in large, bold lettering — that airborne virus can be inhaled even when one is more than six feet away from an infected individual. The new language, posted online, is a change from the agency's previous position that most infections were acquired through "close contact, not airborne transmission."

As the pandemic unfolded last year, infectious disease experts warned for months that both the C.D.C. and the World Health Organization were overlooking research that strongly suggested the coronavirus traveled aloft in small, airborne particles. Several scientists on Friday welcomed the agency's scrapping of the term "close contact," which they criticized as vague and said did not necessarily capture the nuances of aerosol transmission.

"C.D.C. has now caught up to the latest scientific evidence, and they've gotten rid of some old problematic terms and thinking about how transmission occurs," said Linsey Marr, an aerosol expert at Virginia Tech.

Incredible week. First the WHO, now the CDC. It'll take work to have all this be heard, and correctly. Just today, I saw Canada is planning to close beaches "to protect against variants." It takes more than a few website updates to fix a year of messaging. https://t.co/HYSCgWOf71

> The coronavirus spreads through airborne transmission, particularly indoors, and even beyond six feet, the CDC emphasized on Friday. The new guidance is a change from the agency\u2019s previous position that most infections were through \u201cclose contact.\u201d https://t.co/Iq3BuxKcGE
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> — The New York Times (@nytimes) May 7, 2021

To get the significance of this, *just last week*, key UK infection control societies published a review with the same conflations/errors that CDC and WHO just moved towards correcting—and rated fomite and aerosol transmission (outside of medical procedures) as equally possible.

I want to add this here. Also, the story is really fascinating and much longer in terms of the sociology of science, standards of evidence, the scientific details and more, but we cut it to "only" about 5,000 words because that's already so long. ■ https://t.co/KbVVhILmi1

> It's all now called "essays" when you do analyses. Thank you! :-D It was fact-checked within an inch of its life by a team. Pretty much every word is deeply documented. Also I have maybe there times the story, that could easily past similar fact-checking, but already so long!
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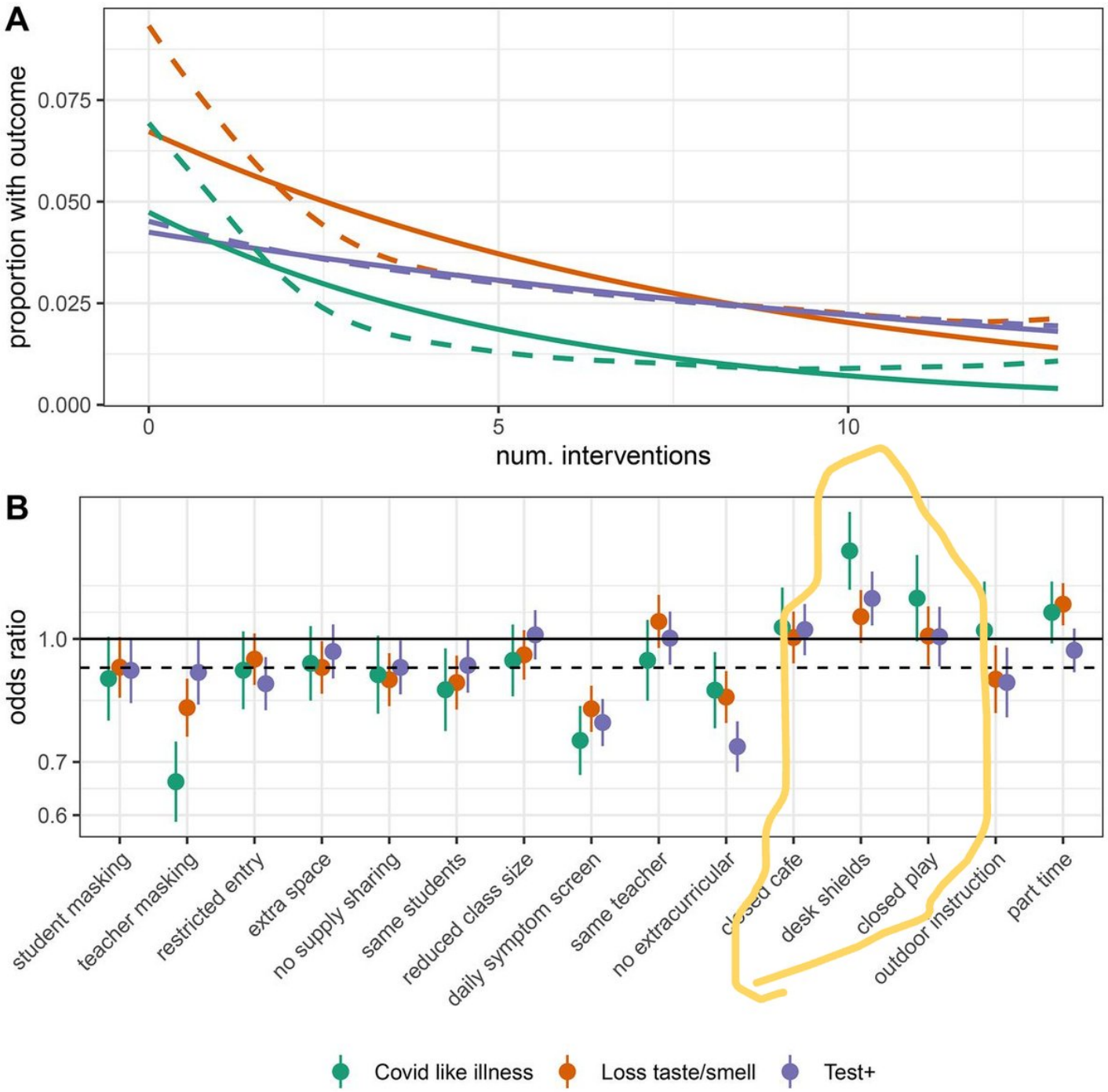
> — zeynep tufekci (@zeynep) May 7, 2021

I have a growing databases detailing rules and restrictions around the world—to this day—that made sense from where we started—short-range respiratory droplets—but do not make sense at all, and are even counterproductive. Need to change that AND also emphasize what remains same.

Aerosol scientists kept telling me that plexiglass barriers might be making things *worse* by blocking ventilation. Just out in Science. Desk shields associated with *increased* illness risk in schools. Closing playground? Also uptick. So many upshots. https://t.co/lcyt647Xkm



On that: the epidemiological record is clear. And the science explains why. Note that as I wrote, it's not completely safe if you engaging close and prolonged contact among unvaccinated people. But it's absolutely SO much safer. We need a very different approach to the outdoors https://t.co/stMtyfLJVd

> No shit there's aerosol transmission (in addition to other kinds). Huge leap from there to "outdoors is safe."
>
> — R.W. Apple Jr. Jr. (@bengardnernyc) May 7, 2021

Yes! Some of what we can try to do now, and for likely other respiratory diseases going forward, is not necessarily expensive, and some that is expensive is a better return for us than excessive hygiene theater and plexiglass and all the rest. And good for health in general! https://t.co/Man8hBO0MT

I wonder if we'll repeat that mistake with "poor ventilation" being taken as "not having state-of-the-art HVAC".

To me, you'd want to have something like schools in Japan (big, airy windows; no central air/heating) rather than a super advanced HVAC system.

— Allan (@AllanRicharz) May 7, 2021