# The Massive Responsibility to Safeguard Students: Why Schools Must Disinfect the Air

Scan the website of any school that has reopened in the Covid-19 era, and you'll find a litany of "enhanced disinfection protocols."

Cleaning schedules for white boards, light switches, and cafeteria microwaves. Lists of government-approved carpet disinfectants. An accounting of "hypochlorous acid disinfectant wipes" in staff restrooms.

Keep clicking and you'll find the school's "physical distancing framework" — protocols for university shuttles and chemistry labs, guidelines for classroom desk dividers and elevator occupancy.

As schools welcome students and teachers back to class, they are seeking to inspire confidence in their Covid-19 precautions. But just how effective are all these measures?

It's a high-stakes question. Already, more than 50,000 coronavirus cases[1] have been reported by U.S. colleges, U.S. pediatric cases have hit half a million[2], and outbreaks have forced schools worldwide — from Wales to Israel to the United States — to close just days after re-opening.

In Berlin, Germany, coronavirus cases were reported by at least 41 schools a fortnight after the capital's 825 schools reopened.

## Coronavirus Cases

**50,000** US COLLEGES

**500,000** PEDICATRIC CASES

As for the answer: Scientists say schools are largely missing the boat.

"Surfaces are not really the problem," asserts[3] microbiologist Emanuel Goldman, Ph.D., of Rutgers New Jersey Medical School. "What [schools] really should be doing is focusing on the main routes of transmission of this disease, which is breathing."

That's why physical distancing measures indoors are of limited value, too.

> **"Distance alone will never solve the aerosol problem,"** says[4] Jose-Luis Jimenez, Ph.D., a University of Colorado chemist. **"If you are in the same room, you can get infected."**

It's well documented that coronavirus particles can linger in the air and travel across a room. To protect students and staff from inhaling these particles, schools must focus less on disinfecting desks and more on disinfecting the air.

Of course, SARS-CoV-2, the virus that causes Covid-19, isn't the only pathogen swirling about campuses. School buildings are reservoirs for a range of airborne viruses and bacteria, as well as asthma-inducing mold spores and pollutants such as volatile organic compounds (VOCs). The coronavirus pandemic has only underscored the need for schools to deploy air-disinfection technologies year-round.

"They're not only going to be helpful for Covid-19 but for next year's flu season," says[5] David Brenner, Ph.D., a Columbia University physicist.

And not just to minimize influenza spread but also to quell the inevitable outbreaks of norovirus, common cold, and even high infectious diseases such as measles, now making a comeback[6] around the world. As one American epidemiologist noted[7], once the Covid pandemic fades, schools will continue to have "the massive responsibility to safeguard the health and well-being of their students."

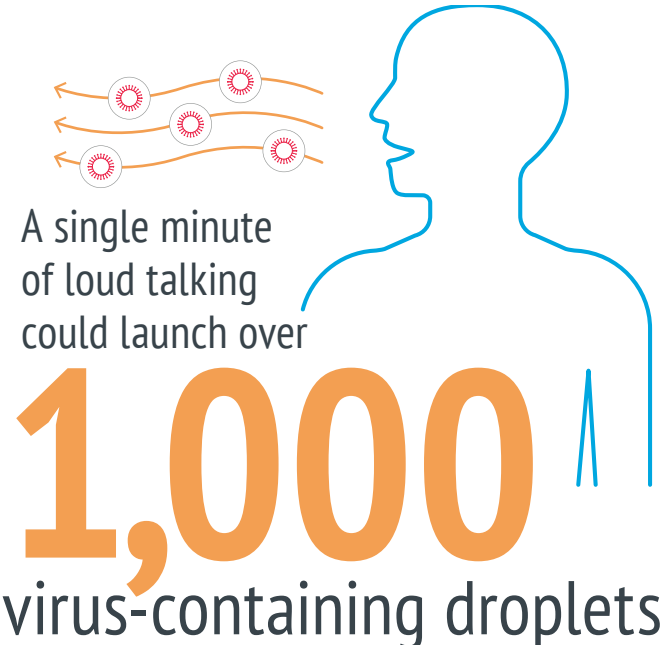
# Why Surface Cleaning and the 6-Foot Rule Fall Short

Scientists agree surface cleaning plays a minor role, at best, in controlling transmission of SARS-CoV-2. In fact, elaborate disinfection measures have been dubbed "hygiene theater,"[8] a feel-good display of concern that provides little actual protection.

School surface protocols emerged after early research suggested SARS-CoV-2 can survive for days on metal and cardboard. But recent analyses found those studies used exaggerated conditions. As Columbia's Dr. Goldman notes, up to 100 people would need to sneeze in the precisely the same spot to match some of the experimental conditions.

The early studies, Goldman argues,[9] "stacked the deck to get a result that bears no resemblance to the real world."

What ***is*** happening in the real world: aerosol transmission, often by young people with no symptoms. A student who feels top notch can, merely by asking a question, emit infectious particles light enough to sail across a classroom, even a lecture hall. A single minute[10] of loud talking could launch over 1,000[11] virus-containing droplets.




Depending on the conditions, SARS-CoV-2 can travel well beyond 6 feet, the default distancing guidance for schools. In one hospital study, scientists captured viable airborne coronavirus[12] particles nearly 16 feet away from a hospitalized Covid patient.

> **"Six feet is a fine number, but we need to convey that this is a starting point,"** says[13] Linsey Marr, Ph.D., a Virginia Tech environmental engineer.

The guidance dates from 19th-century research[14] suggesting 6 feet was as far as microbe-laden droplets could travel. Today's more sophisticated studies, using laser-light technology, demonstrate that droplets exist in a range of sizes, cluster in invisible clouds, and can travel much farther indoors.

Case reports bolster the evidence. For example, in a well-known Washington choir practice[15], one singer spread SARS-CoV-2 as far as 44 feet; 53 of 61 choir members became infected, and two died.

No doubt infectious particles can waft about classrooms, hallways, staff lounges — anywhere on campus, including restrooms.

"When you flush a toilet, the churning and bubbling of water aerosolizes fecal matter," explains[16] Joseph Allen, Ph.D., director of the Healthy Buildings program at Harvard's school of public health. "You're breathing in toilet water and whatever is in that toilet water — including viruses and bacteria."

SARS-CoV-2 may well be among those viruses.

In hospital studies[17], traces of coronavirus RNA have been detected in air samples collected near toilets of Covid-19 patients. Bioaerosols may linger for more than 30 minutes after a flush, other research has found. What's more, compared to toilets with lids, lidless toilets — standard in elementary and secondary schools — increase[18] the risk infectious particles will escape.

Enforcing the 6-foot rule won't lower the odds that a student or staff member might inhale those particles. Neither will scrupulous disinfection of door handles and microwaves.

All in all, experts concur, school Covid precautions are falling short. Indeed, one American epidemiologist called[19] the priorities at her own child's school — one-way hallways, frequent sanitizing, temperature checks — "dangerously misdirected."

Airborne coronavirus spread, she lamented, was "absent from the conversation."

# Ventilation and Filtration: School Buildings Must Do More

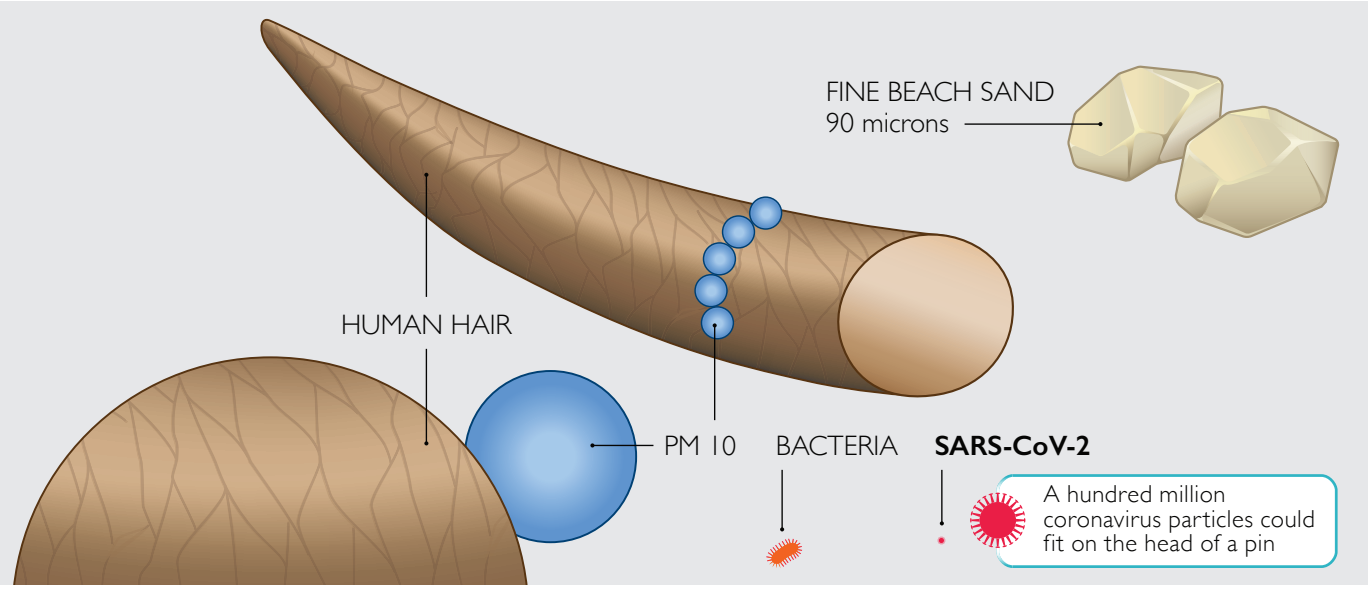
That's not the case everywhere. Some school websites do discuss ventilation and air filtration, critical strategies for controlling airborne spread. But here again, actions fall short.

Open windows are a simple way to reduce airborne concentration of coronavirus particles, but many classrooms have no windows. In others, the windows are bolted shut. Even when windows are operational, they're often kept closed to keep out allergy-inducing pollen or blasts of cold air.

American public schools are notorious for ventilation deficiencies. A recent analysis documented ventilation problems in 60%[20] of New York City schools with ventilation reports. Well before the emergence of Covid, the U.S. Environmental Protection Agency (EPA) reported[21] poor indoor air quality in U.S. schools may pose a "serious health threat" to students and staff.

The EPA was referring to airborne contaminants emitted by a wide range of biological and chemical sources, from moldy ceiling tiles to cockroach dander to idling school buses and vaping devices. But the ventilation deficiencies that expose students and staff to pollutants also leave them vulnerable to SARS-CoV-2.

So do shortcomings in air filtration. At many schools, the HVAC systems just aren't equipped to handle high-level systems. As one American college concedes[22], adopting a more powerful filtration system "could very well cause system failure." Even stand-alone HEPA filters won't capture 100% of coronavirus particles, some of which are 900 times[23] smaller than the width of a human hair.



One toxicologist, a member of the American Industrial Hygiene Association, described[24] school filtration systems as "designed to control body odor, to be honest." SARS-CoV-2, he noted, is a highly contagious aerosol. "We're being asked to suspend disbelief and believe that buildings were designed to protect us against infections. You're going to have to do more."

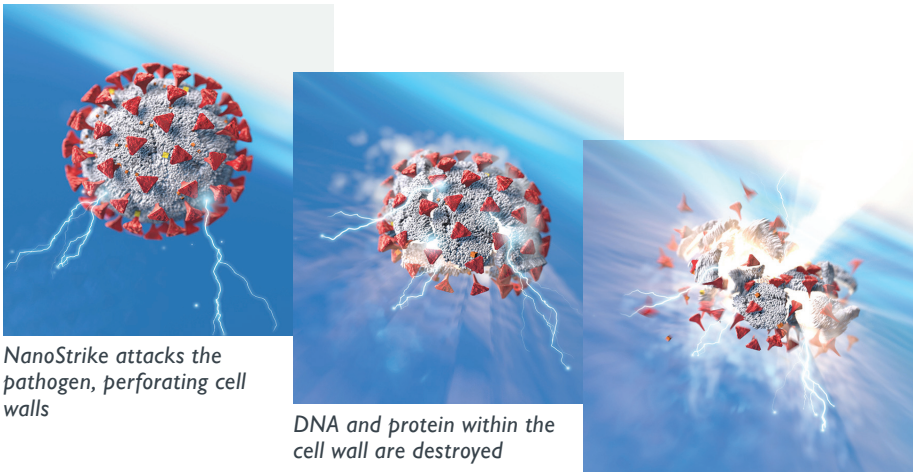
What more can be done?

Ultraviolet (UV) light technologies, designed to kill viral particles that slip through filters, are often touted as alternatives. But UV rays pose their own health risks[25], which is why they're used to disinfect subway trains after hours and elevators not in use. UV light is not a practical or safe way to destroy coronavirus particles hovering in classrooms.

A far better solution is an ultra-low energy plasma-based nanotechnology from WellAir, called NanoStrike®.

NanoStrike is the technology that powers all Novaerus portable air dis-infection units. They come in a variety of sizes, are unobtrusive, and can be easily placed or mounted in classrooms, dorm rooms, restrooms, school nurse's offices, campus health centers, and other high-risk spaces.


The Novaerus portable air dis-infection units house a series of coil tubes that generate an electrical discharge, not unlike the plasma emitted by lightening. A high-quality fan draws contaminated air into the chamber where, in nanoseconds, the DNA of pathogens becomes stretched by the plasma and explodes into inert, harmless debris. Clean air is then expelled back into the room.



*NanoStrike attacks the pathogen, perforating cell walls*

*DNA and protein within the cell wall are destroyed*

*Cell bursts due to osmotic pressure*

Unique among air-disinfection solutions, NanoStrike technology leaves behind no harmful by-products.

Novaerus units are so safe, even for the most vulnerable populations, that they are commonly deployed in hospital ICUs, operating theaters, and emergency rooms. Designed to protect both patients and medical staff from infection, the units run 24/7. With a highly infectious virus such as SARS-CoV-2, continual air disinfection is critical.

The same sleek, white metal boxes can now be found in universities and schools alike.

NanoStrike technology, proven highly effective by independent lab testing, has long been used to fight influenza, norovirus, measles, MRSA — any number of viral and bacterial diseases. Tests also have confirmed the Novaerus portable devices destroy airborne toxins such as VOCs and fine particulate matter.

Now, lab tests confirm NanoStrike technology can reduce airborne load of MS2 Bacteriophage, a virus used as a surrogate for SARS-CoV-2, by 99.99% in just 15 minutes.* Hospitals worldwide, from Wuhan to Budapest, have installed the units in their Covid wards.

*The Novaerus Defend 1050 air dis-infection unit was shown to reduce the virus by 99.99% in 15 minutes.

Novaerus portable units, powered by NanoStrike Technology can help to remove airborne viruses which travel in tiny aggregated droplets that can linger for hours before they settle on surfaces.

| | | |
|---|---|---|
| **VIRUSES** | • SARS-CoV-2<br>• Influenza A<br>• Phi X 174 | • Norovirus<br>• Measles |
| **BACTERIA** | • MRSA<br>• *Bacillus subtilis*<br>• *Staphylococcus epidermidis* | • Tuberculosis<br>• *Escherichia coli*<br>• *C. difficile* |
| **MOLD SPORES** | • *Aspergillus niger* | |
| **VOCs** | • Formaldehyde | |

REDUCING
MS2 bacteriophage
by **99.99%**
a surrogate for **SARS-CoV-2,**
the virus causing **COVID-19**

# Schools Must Prioritize Air Disinfection

The stakes for schools have never been higher. At least 6 American school teachers[26] died from Covid-19 in the weeks after schools re-opened. Mississippi reported over 600 cases among teachers and staff.

In Italy, concerns were raised as the country with the oldest teaching workforce in the EU returned to school. More than half[27] of primary and secondary school teachers in Italy are over the age of 50, with 17% over 60.

Schools are working hard to keep staff and students safe. At the same time, administrators and building operators are inundated with conflicting guidance — from government authorities and public-health experts — on how best to minimize coronavirus spread.

Recently, the CDC has updated its guidance on how COVID-19 spreads, acknowledging that the coronavirus can spread via airborne transmission.

"People have prevention fatigue," says[28] Dr. Emanuel Goldman, the Columbia microbiologist. "They're exhausted by all the information we're throwing at them. We have to communicate priorities clearly."

In schools, Dr. Goldman asserts, the top priority must be air disinfection. An investment made during the pandemic will pay dividends in the aftermath.

"Covid-19 is not the first — and will not be the last — infectious disease to threaten our society," says[29] Harvard's Joseph Allen, co-author of ***Healthy Buildings***. "School building systems in general have historically been underfunded, under-ventilated, and under-prepared."

By deploying WellAir's NanoStrike technology, schools will find themselves prepared for future waves of Covid-19 and the inevitable outbreaks of other highly infectious diseases.

# Endnotes


1 https://www.nytimes.com/interactive/2020/us/covid-college-cases-tracker.html

2 https://edition.cnn.com/world/live-news/coronavirus-pandemic-09-08-20-intl/h_d694b051a612520a756ebb42493a7322

3 https://www.washingtonpost.com/gdpr-consent/?next_url=https%3a%2f%2fwww.washingtonpost.com%2flifestyle%2fstyle%2fdeep-cleans-and-disinfecting-mists-might-not-keep-us-from-getting-the-virus-but-they-sure-make-us-feel-better%2f2020%2f09%2f05%2ff428b8ee-e965-11ea-97e0-94d2e46e759b_story.html%3fhpid%3dhp_hp-top-table-main_covidtheater-730am%253Ahomepage%252Fstory-ans&hpid=hp_hp-top-table-main_covidtheater-730am%3Ahomepage%2Fstory-ans

4 https://www.washingtonpost.com/gdpr-consent/?next_url=https%3a%2f%2fwww.washingtonpost.com%2fhealth%2f2020%2f08%2f27%2fcoronavirus-social-distancing-6-feet%2f

5 https://www.washingtonpost.com/climate-environment/2020/06/26/coronavirus-indoor-air-schools-offices/?arc404=true

6 https://www.mdedge.com/chestphysician/article/214783/infectious-diseases/measles-comeback-2019

7 https://www.cnn.com/interactive/2020/health/reopening-coronavirus/college.html

8 https://www.theatlantic.com/ideas/archive/2020/07/scourge-hygiene-theater/614599/

9 https://www.theatlantic.com/ideas/archive/2020/07/scourge-hygiene-theater/614599/?utm_source=Nature+Briefing&utm_campaign=18a4d663bb-briefing-dy-20200729&utm_medium=email&utm_term=0_c9dfd39373-18a4d663bb-44148609

10 https://www.pnas.org/content/early/2020/05/12/2006874117

11 https://pubmed.ncbi.nlm.nih.gov/32404416/

12 https://www.medrxiv.org/content/10.1101/2020.08.03.20167395v1.full.pdf

13 https://www.washingtonpost.com/health/2020/08/27/coronavirus-social-distancing-6-feet/

14 https://jamanetwork.com/journals/jama/fullarticle/2763852

15 https://www.cdc.gov/mmwr/volumes/69/wr/mm6919e6.htm

16 https://www.washingtonpost.com/opinions/2020/09/01/its-time-talk-about-how-toilets-may-be-spreading-covid-19/

17 https://www.nature.com/articles/s41586-020-2271-3

18 https://abcnews.go.com/blogs/health/2012/01/02/flushing-can-spread-diarrhea-disease

19 https://www.statnews.com/2020/08/05/ventilation-part-of-school-reopening-conversation/

20 https://ny.chalkbeat.org/2020/8/25/21396573/how-safe-is-the-air-inside-nyc-classrooms?campaign_id=174&emc=edit_csb_20200826&instance_id=21622&nl=coronavirus-schools-briefing&regi_id=65173045&segment_id=36946&te=1&user_id=47af531f2feabc06af3fbbb03259639d

21 https://www.epa.gov/iaq-schools/reference-guide-indoor-air-quality-schools

22 https://www.missouriwestern.edu/covid-19/campus-precautions/#air

23 https://m.economictimes.com/news/politics-and-nation/a-10-point-guide-to-protect-yourself-from-the-coronavirus-spread/your-handy-guide/slideshow/74454635.cms

24 https://ny.chalkbeat.org/2020/8/25/21396573/how-safe-is-the-air-inside-nyc-classrooms?campaign_id=174&emc=edit_csb_20200826&instance_id=21622&nl=coronavirus-schools-briefing&regi_id=65173045&segment_id=36946&te=1&user_id=47af531f2feabc06af3fbbb03259639d

25 https://www.cancer.org/cancer/cancer-causes/radiation-exposure/uv-radiation.html#:~:text=UVB%20rays%20have%20slightly%20more,other%20types%20of%20UV%20rays.

26 https://www.pbs.org/newshour/education/teacher-deaths-from-covid-19-raise-alarms-as-new-school-year-begins

27 https://gpseducation.oecd.org/CountryProfile?primaryCountry=ITA&treshold=10&topic=EO

28 https://www.theatlantic.com/ideas/archive/2020/07/scourge-hygiene-theater/614599/?utm_source=Nature+Briefing&utm_campaign=18a4d663bb-briefing-dy-20200729&utm_medium=email&utm_term=0_c9dfd39373-18a4d663bb-44148609

29 https://www.cnn.com/interactive/2020/health/reopening-coronavirus/college.html