

CDC's Recognition of Aerosol Transmission of Covid-19 is Essential to an Effective and Successful Pandemic Response

Since the Covid-19 pandemic began in the United States in January 2020, our country has been in crisis. Despite clear scientific and public health consensus on interventions that could slow the spread of the virus and reduce illness, suffering, and death, the Trump Administration failed to take the necessary steps to control the pandemic.

Over a year into the worst public health crisis in recent history, nurses and other health care workers continue to care for Covid-19 patients and other patients without access to optimal personal protective equipment (PPE), testing, safe staffing levels, and other sound infection control policies. Health care employers rationalize policies that place nurses and health care workers at risk of Covid by saying they are following guidance from the Centers of Disease Control and Prevention (CDC).

Up to January 2021, the federal government's response to the pandemic has been one of denial and abandonment. President Biden recommitted to a strong, science-based pandemic response.

We were hopeful after the inauguration that we would quickly see changes in CDC guidance that would strengthen recommendations for protecting nurses and other frontline workers. We have been disappointed by the fact that critical improvements have not yet been made over the past two months.

In order to bring Covid-19 under control, the CDC needs to immediately improve their guidance, which will then improve the pandemic response on the ground in hospitals, workplaces, and communities across the country.

On behalf of more than 170,000 registered nurses, National Nurses United, the largest labor union and professional association for registered nurses in the United States, urges the CDC to take immediate action to immediately update all Covid guidance to fully recognize the significant role aerosol transmission plays in the spread of Covid.

The following is a detailed outline of the scientific evidence and consensus around aerosol transmission of Covid, how CDC guidance needs to be updated to reflect that evidence, and a critique of the health care industry's narrative about aerosol transmission and health care worker protections.

Scientific Evidence on Aerosol Transmission of SARS-CoV-2

Scientific evidence regarding aerosol transmission of SARS-CoV-2 is overwhelming. We urge the CDC to leave behind their outdated “droplet vs airborne” framework and update their understanding of respiratory pathogen transmission based on a vast body of research. This section outlines recent evidence underlining the significant and primary role aerosol transmission plays in the spread of SARS-CoV-2.

1. Infected individuals emit infectious aerosol particles.

- a. Infectious SARS-CoV-2 virus was readily isolated from upper respiratory tract samples of patients hospitalized with Covid-19, even in the absence of a cough. High viral loads were also found to be more than 1,000 times higher for SARS-CoV-2 compared to SARS-CoV-1.¹
- b. Researchers collected exhaled breath condensate from 57 Covid-19 patients, four hospitalized non-Covid-19 patients, and 15 healthy individuals in Beijing. Exhaled breath samples had the highest positive rate; Covid-19 patients emitted millions of SARS-CoV-2 particles into the air per hour.²
- c. Researchers recovered viable SARS-CoV-2 virus in the air from hospital rooms with Covid-19 patients, collected 6.5 to 15.7 feet away from the patients.³
- d. SARS-CoV-2 was detected in respired aerosols <5 µm in diameter around six patients, collected beyond 6 feet, produced through normal breathing, vocalization, and coughing. This study also showed infectious, replicating virions in aerosol samples <1 µm in diameter.⁴
- e. Researchers detected SARS-CoV-2 in air samples taken greater than 6 feet from isolated Covid-19 patients and in air samples worn by sampling personnel, in the absence of a cough.⁵
- f. Researchers detected viral presence in exhaled breath, even without cough, for seasonal coronaviruses, influenza viruses, and rhinoviruses in both respiratory droplet (>5 µm) and aerosol (<5 µm) particles.⁶

¹ Wölfel, R., V.M. Corman, et al., “Virological assessment of hospitalized patients with COVID-2019,” *Nature*, April 1, 2020, <https://www.nature.com/articles/s41586-020-2196-x>.

² Ma, J., X. Qi, et al., “COVID-19 patients in earlier stages exhaled millions of SARS-CoV-2 per hour,” *Clinical Infectious Diseases*, Aug 28, 2020, <https://pubmed.ncbi.nlm.nih.gov/32857833/>.

³ Lednicky, J.A., M. Lazuardo, et al., “Viable SARS-CoV-2 in the air of a hospital room with COVID-19 patients,” *International Journal of Infectious Diseases*, Sept 15, 2020, [https://www.ijidonline.com/article/S1201-9712\(20\)30739-6/fulltext](https://www.ijidonline.com/article/S1201-9712(20)30739-6/fulltext).

⁴ Santarpia, J.L., V.L. Herrera, et al., “The Infectious Nature of Patient-Generated SARS-CoV-2 Aerosol,” *medRxiv*, July 21, 2020, (preprint) <https://www.medrxiv.org/content/10.1101/2020.07.13.20041632v2>.

⁵ Santarpia, J.L., D.N. Rivera, et al., “Aerosol and surface contamination of SARS-CoV-2 observed in quarantine and isolation care,” *Scientific Reports*, July 29, 2020, <https://www.nature.com/articles/s41598-020-69286-3>.

⁶ Leung, N.H.L., D.K.W. Chu, et al., “Respiratory virus shedding in exhaled breath and efficacy of face masks,” *Nature Medicine*, April 3, 2020, <https://www.nature.com/articles/s41591-020-0843-2>.

- g. Researchers found that recovering Covid-19 patients still exhaled thousands of SARS-CoV-2 per minute. The virus was also detected in hospital air samples, and surface swabs.⁷
- 2. SARS-CoV-2 virus has been found in a range of aerosol particle sizes, including less than 5 microns and less than 1 micron.**
 - a. Air sampling of two Covid-19 patients detected SARS-CoV-2 aerosol particles in >4 μm and 1 - 4 μm in diameter.⁸
 - b. SARS-CoV-2 was detected in respired aerosols <5 μm in diameter around six patients, collected beyond 6 feet, produced through normal breathing, vocalization, and coughing. This study also showed infectious, replicating virions in aerosol samples <1 μm in diameter.⁹
 - 3. SARS-CoV-2 can survive and remain infectious when suspended in aerosol particles.**
 - a. Researchers found that SARS-CoV-2 can remain infectious for up to 16 hours suspended in aerosols.¹⁰
 - b. Researchers found that SARS-CoV-2 can survive in aerosols suspended in the air for at least 3 hours and on surfaces for several days.¹¹
 - 4. When infected individuals breathe, cough, sneeze, or vocalize, they emit aerosol particles in a wide range of sizes. These particles can travel through the air to distances farther than six feet and can remain suspended in the air for long periods of time.**
 - a. Pathogen-carrying gas clouds emitted when people breath, cough, and sneeze can travel up to 23 – 27 feet.¹²
 - b. Researchers found that a diner (index case) in South Korea infected two other people after five minutes of exposure from a distance of 4.8 meters (15 feet) and

⁷ Zhou, L., M. Yao, et al., “Breath-, air- and surface-borne SARS-CoV-2 in hospitals,” *Journal of Aerosol Science*, Feb 2021, Vol 152: 105693,

<https://www.sciencedirect.com/science/article/abs/pii/S0021850220301786?via%3Dihub>.

⁸ Chia, P.Y., K.K. Coleman, et al., “Detection of air and surface contamination by SARS-CoV-2 in hospital rooms of infected patients,” *Nature Communications*, May 29, 2020, <https://www.nature.com/articles/s41467-020-16670-2>.

⁹ Santarpia, J.L., et al. medRxiv, July 21, 2020.

¹⁰ Fears, A.C., W.B. Klimstra, et al., “Persistence of Severe Acute Respiratory Syndrome Coronavirus 2 in Aerosol Suspensions,” *Emerging Infectious Diseases*, Sept 2020, Vol 26, No 9, https://wwwnc.cdc.gov/eid/article/26/9/20-1806_article.

¹¹ van Doremalen, N., D.H. Morris, et al., “Aerosol and Surface Stability of SARS-CoV-2 as Compared with SARS-CoV-1,” *New England Journal of Medicine*, April 16, 2020, <https://www.nejm.org/doi/full/10.1056/nejmc2004973>.

¹² Bourouiba, L., “Turbulent Gas Clouds and Respiratory Pathogen Emissions: Potential Implications for Reducing Transmission of COVID-19,” *JAMA*, March 26, 2020, <https://jamanetwork.com/journals/jama/fullarticle/2763852>.

6.5 meters (21 feet). Interviews, credit card records, cell phone location data, CCTV footage and PCR testing were collected.¹³

- c. Researchers found that normal conversations can create a turbulent, jet-like airflow that can transport exhaled breath over two meters (6.5 feet) in front of the speaker, potentially further, within 30 seconds.¹⁴
- d. Researchers found that the time-of-flight to reach 6.5 feet is only a few seconds resulting in a viral dose above the minimum required for Covid-19 infection, implying that physical distance alone in the absence of ventilation and respiratory protection is insufficient to provide safety for long exposure times.¹⁵

5. Multiple outbreak investigations have found that aerosol transmission is the only explanation for the outbreak.

- a. An epidemiological investigation determined that a correctional officer in Vermont contracted SARS-CoV-2 after multiple brief encounters with six asymptomatic incarcerated individuals. Each interaction lasted about one minute, totaling 17 minutes of exposure over an eight-hour shift. The officer wore a microfiber cloth mask, gown, goggles, and gloves, and maintained six feet from the infected inmates the entire time. The officer had no known contact with anyone else with Covid-19 and coronavirus cases were low in his home county and in the rest of the correctional facility at the time, leading researchers to conclude that his exposure most likely came from the brief encounters.¹⁶
- b. An outbreak investigation in an Israeli pediatric hospital identified six health care worker nosocomial infections from an asymptomatic patient that tested negative for Covid-19 upon admission. All six health care workers became infected despite wearing surgical masks at all times after providing routine patient care, which lasted less than 10 minutes. Three of the six health care workers had no contact with the patient and maintained physical distance.¹⁷
 - i. Note that this study underlines the faultiness of CDC's focus on "droplet" transmission. CDC says droplet transmission occurs when large droplets

¹³ Kwon, K.S., J.I. Park, et al., "Evidence of Long-Distance Droplet Transmission of SARS-CoV-2 by Direct Air Flow in a Restaurant in Korea," *Journal of Korean Medical Science*, Nov 30, 2020, <https://jkms.org/DOIx.php?id=10.3346/jkms.2020.35.e415>.

¹⁴ Abkarian, M., S. Mendez, et al., "Speech can produce jet-like transport relevant to asymptomatic spreading of virus," *Proceedings of the National Academy of Sciences*, Sept 25, 2020, <https://www.pnas.org/content/117/41/25237/tab-article-info>.

¹⁵ de Oliveira, P.M., L.C.C. Mesquita, et al., "Evolution of spray and aerosol from respiratory releases: theoretical estimates for insight on viral transmission," *Proceedings of the Royal Society A: Mathematical, Physical and Engineering Sciences*, Jan 20, 2021, <https://royalsocietypublishing.org/doi/10.1098/rspa.2020.0584>.

¹⁶ Pringle, J.C., J. Leikaukas, et al., "COVID-19 in a Correctional Facility Employee Following Multiple Brief Exposures to Persons with COVID-19 — Vermont, July–August 2020," *MMWR Early Release*, Oct 30, 2020, <https://www.cdc.gov/mmwr/volumes/69/wr/mm6943e1.htm>.

¹⁷ Goldberg, L., Y. Levinsky, et al., "SARS-CoV-2 Infection Among Health Care Workers Despite the Use of Surgical Masks and Physical Distancing—the Role of Airborne Transmission," *Open Forum Infectious Diseases*, Jan 27, 2021, <https://academic.oup.com/ofid/advance-article/doi/10.1093/ofid/ofab036/6121257>.

are emitted by infected individuals and those droplets are inhaled by someone close to the infected individual.¹⁸ CDC's droplet precautions include wearing a surgical mask.¹⁹ Surgical masks in combination with physical distancing did not stop transmission in this outbreak.

- c. Detailed investigation of the Skagit Valley Chorale outbreak found that SARS-CoV-2 transmission was dominated by inhalation of respiratory aerosols generated by one index case. After evaluating several influential factors such as ventilation rate, duration of event, and deposition onto surfaces, researchers determined that aerosol transmission was the only explanation for the outbreak.²⁰
- d. A SARS-CoV-2 outbreak investigation of a large meat processing complex in Germany found that a single index case led to 1,500 worker infections. SARS-CoV-2 virus was transmitted between workers more than 26 feet away from each other who had no other points of contact.²¹
- e. A cluster investigation from Brigham and Women's Hospital found that 15 patients and 42 health care workers became infected with Covid-19 from a patient whose isolation was removed after testing negative for the virus. Whole-genome sequencing confirmed that some health care workers were infected despite wearing surgical masks and eye protection.²²
 - i. Note that this study underlines the faultiness of CDC's focus on "droplet" transmission. CDC says droplet transmission occurs when large droplets are emitted by infected individuals and those droplets are inhaled by someone close to the infected individual.²³ CDC's droplet precautions include wearing a surgical mask.²⁴ Surgical masks in combination with physical distancing did not stop transmission in this outbreak.

¹⁸ U.S. Centers for Disease Control and Prevention, "Science Brief: SARS-CoV-2 and Potential Airborne Transmission," updated Oct 5, 2020, <https://www.cdc.gov/coronavirus/2019-ncov/science/science-briefs/scientific-brief-sars-cov-2.html>.

¹⁹ U.S. Centers for Disease Control and Prevention, "Transmission-Based Precautions," page last reviewed Jan 7, 2016, <https://www.cdc.gov/infectioncontrol/basics/transmission-based-precautions.html>.

²⁰ Miller, S.L., W.W. Nazaroff, et al., "Transmission of SARS-CoV-2 by inhalation of respiratory aerosol in the Skagit Valley Chorale superspreading event," *Indoor Air*, Sept 26, 2020, <https://onlinelibrary.wiley.com/doi/full/10.1111/ina.12751>.

²¹ Günther, T., M. Czech-Sioli, et al., "SARS-CoV-2 outbreak investigation in a German meat processing plant," *EMBO Molecular Medicine*, Oct 27, 2020, <https://www.embopress.org/doi/full/10.15252/emmm.202013296>.

²² Klompas, M., M.A. Baker, et al., "A SARS-CoV-2 Cluster in an Acute Care Hospital," *Annals of Internal Medicine*, Feb 9, 2021, <https://www.acpjournals.org/doi/full/10.7326/M20-7567>.

²³ U.S. Centers for Disease Control and Prevention, "Science Brief: SARS-CoV-2 and Potential Airborne Transmission," updated Oct 5, 2020, <https://www.cdc.gov/coronavirus/2019-ncov/science/science-briefs/scientific-brief-sars-cov-2.html>.

²⁴ U.S. Centers for Disease Control and Prevention, "Transmission-Based Precautions," page last reviewed Jan 7, 2016, <https://www.cdc.gov/infectioncontrol/basics/transmission-based-precautions.html>.

- f. An epidemiological investigation in a department store in China identified 43 Covid-19 cases. After analyzing interviews and surveillance footage, researchers found that 12 out of 43 patients were infected at distances beyond reach of droplet, making aerosol transmission likely.²⁵
- g. Researchers detected SARS-CoV-2 in central ventilation systems of three Covid-19 wards in a Swedish hospital. Viral SARS-CoV-2 RNA was detected in ventilation exhaust filters located at least 50 meters (164 feet) from patient room vent openings within wards, indicating long-distance aerosol transmission.²⁶
- h. Mathematical modelling using case data from the Diamond Princess cruise ship outbreak found: “Our results show that airborne transmission by small aerosols containing SARS-CoV-2 was most likely the dominant mode of COVID-19 transmission aboard the ship, even with assumptions of a very high ventilation rate (9 to 12 air changes per hour) and no air recirculation, which are both conservative assumptions that favor against long-range airborne transmission. The long range and short-range transmission routes had similar contributions to the total number of infected cases. However, aerosol transmission across both short- and long-range distances accounted for >50 percent of disease transmission overall, which is contrary to the prevailing positions on how COVID-19 is spread held by organizations like WHO and CDC, but is consistent with emerging evidence for airborne transmission.”²⁷

Wide Scientific Consensus Regarding the Need to Recognize Aerosol Transmission of SARS-CoV-2

- 1. Experts, professional associations, and other organizations have urged the CDC and the rest of the U.S. government to fully recognize aerosol transmission of SARS-CoV-2.**
 - a. A group of experts sent a letter on Feb 15, 2021 urging the White House, CDC, and National Institutes of Health (NIH) to take immediate action to address SARS-CoV-2 inhalation exposure.²⁸

²⁵ Jiang, G., C. Wang, et al., “Aerosol transmission, an indispensable route of COVID-19 spread: case study of a department-store cluster,” *Frontiers of Environmental Science & Engineering*, Dec 25, 2020, <https://pubmed.ncbi.nlm.nih.gov/33391845/>.

²⁶ Nissen, K., J. Krambrich, et al., “Long-distance airborne dispersal of SARS-CoV-2 in COVID-19 wards,” *Scientific Reports*, Nov 11, 2020, <https://www.nature.com/articles/s41598-020-76442-2>.

²⁷ Azimi, P., Z. Keshavarz, et al., “Mechanistic transmission modeling of COVID-19 on the Diamond Princess cruise ship demonstrates the importance of aerosol transmission,” *PNAS*, Feb 23, 2021, <https://www.pnas.org/content/118/8/e2015482118>.

²⁸ Bright, R., L.M. Brosseau, L.R. Goldman, C. Gounder, J. Jimenez, Y. Kawaoka, L. Marr, D. Michaels, D.K. Milton, M. Osterholm, K. Prather, R.T. Schooley, and P. Seminario to J. Zients, R.P. Walensky, and A.S. Fauci, “Re: Immediate Action is Needed to Address SARS-CoV-2 Inhalation Exposure,” Feb 15, 2021, <https://aiha->

- b. National Nurses United and 44 allied unions and organizations sent a petition urging the CDC to update its Covid-19 guidance to fully reflect the latest scientific evidence regarding SARS-CoV-2 transmission through aerosols that infected people emit when they breathe, speak, cough, sneeze, or sing.²⁹ Over 12,000 individuals signed this petition.
- c. The American Industrial Hygiene Association published a joint consensus statement³⁰ to call on the CDC and the Occupational Safety and Health Administration (OSHA) to issue guidance preventing occupational exposures due to aerosol transmission of SARS-CoV-2. Below are co-sponsors of the statement.
 - i. American Conference of Governmental Industrial Hygienists
 - ii. American Association of Aerosol Research
 - iii. Association of Occupational Health Professionals in Healthcare
 - iv. American Thoracic Society
 - v. Association of Schools & Programs of Public Health
 - vi. National Association of Occupational Health Professionals
 - vii. Occupational Health Clinics for Ontario Workers, Inc.
 - viii. Organization for Safety Asepsis and Prevention
 - ix. Society of Critical Care Medicine
- d. The American Society of Heating, Refrigerating and Air-Conditioning Engineering (ASHRAE) released new guidance on January 6, 2021 to address control of airborne infectious aerosol exposure.³¹
- e. Representatives Robert C. “Bobby” Scott, Rosa L. DeLauro, Frank Pallone, Jr., James E. Clyburn, and Alma S. Adams sent a letter on March 1, 2021 to the White House, CDC, and the Department of Labor commending the Biden Administration’s strong, science-based action and expressing “serious questions

assets.sfo2.digitaloceanspaces.com/AIHA/uploads/PressReleases/Immediate-Action-to-Address-Inhalation-Exposure-to-SARS-CoV-2_2142021.pdf.

²⁹ National Nurses United, “Nurses, Unions, Allies Urge CDC to Acknowledge Covid-19 Aerosol Transmission to Help Bring Virus Under Control,” Feb 23, 2021, <https://www.nationalnursesunited.org/press/nurses-unions-allies-urge-cdc-to-acknowledge-covid-19-aerosol-transmission>.

³⁰ Brosseau, L.M., A.H. Mitchell, and J. Rosen, “Joint Consensus Statement on Addressing the Aerosol Transmission of SARS CoV-2 and Recommendations for Preventing Occupational Exposures,” American Industrial Hygiene Association, Feb 1, 2021, <https://aiha-assets.sfo2.digitaloceanspaces.com/AIHA/resources/Fact-Sheets/Joint-Consensus-Statement-on-Addressing-the-Aerosol-Transmission-of-SARS-CoV-2-Fact-Sheet.pdf>.

³¹ ASHRAE Epidemic Task Force, “Core Recommendations for Reducing Airborne Infectious Aerosol Exposure,” Jan 6, 2021, <https://www.ashrae.org/file%20library/technical%20resources/covid-19/core-recommendations-for-reducing-airborne-infectious-aerosol-exposure.pdf>.

about the adequacy of the current Centers for Disease Control and Prevention (CDC) Guidance regarding protections from aerosol transmission of the virus.”³²

- f. The House Education and Labor Committee, Workforce Protections Subcommittee held a hearing on March 11, 2021 titled: “Clearing the Air: Science-Based Strategies to Protect Workers from COVID-19 Infections.” At this hearing, experts testified to the importance and necessity of recognizing aerosol transmission of the coronavirus to ensuring an effective pandemic response, including the importance of the CDC updating its guidance and OSHA issuing strong, enforceable standards.³³
- g. Chairman Bobby Scott released a statement on March 10, 2021 urging the CDC “to follow the evidence and research and direct its energies into improving protections for health care workers, not into eroding them.”³⁴ Chairman Scott also emphasized the “there is no evidence that surgical masks are adequate to prevent exposure of frontline health workers to the virus that causes Covid-19.”
- h. The American Public Health Association (APHA) sent a letter to the U.S. Subcommittee on Workforce Protections on March 10, 2021 urging the CDC to update its guidelines that are consistent with the scientific evidence of inhalation risk. “The best scientific evidence indicates that inhalation is the primary route of transmission of SARS-CoV-2. OSHA standards and CDC guidelines must be updated to fully recognize the significant risk of exposure to the virus through inhalation.”
- i. Senator Alex Padilla sent a letter to the U.S. Department of Labor, the White House, and the CDC on March 27, 2021, urging the CDC “to take additional steps regarding protections from aerosol transmission of the virus.”
- j. Similar communications have been sent to governments around the world. Dr. Lisa Brosseau has collected selected letters and posted them here:
<https://drive.google.com/drive/u/0/folders/16gIPk7UXTu6onIXggM96D5iq107U0wMY>

³² Scott, R.C., R.L. DeLauro, F. Pallone, Jr., J.E. Clyburn, and A.S. Adams to J. Zients, R.P. Walensky, and A. Stewart, March 1, 2021.

³³ House Education & Labor Committee, Workforce Protections Subcommittee, “Clearing the Air: Science-Based Strategies to Protect Workers from COVID-19 Infections,” March 11, 2021, <https://edlabor.house.gov/hearings/clearing-the-air-science-based-strategies-to-protect-workers-from-covid-19-infections>.

³⁴ Scott, B., “Scott Statement on CDC Decision to Weakening Coronavirus Protections for Frontline Health Care Workers,” House Education & Labor Committee, March 10, 2020, <https://edlabor.house.gov/media/press-releases/scott-statement-on-cdc-decision-to-weakening-coronavirus-protections-for-frontline-health-care-workers>.

- 2. Literature reviews and editorials regarding the importance of recognizing aerosol transmission of SARS-CoV-2 have been published by experts.**
- a. Samet, J.M., K. Prather, et al., “Airborne Transmission of SARS-CoV-2: What We Know,” *Clinical Infectious Diseases*, Jan 18, 2021, <https://academic.oup.com/cid/advance-article/doi/10.1093/cid/ciab039/6103221>
 - b. Tang, J.W., W.P. Bahnfleth, et al., “Dismantling myths on the airborne transmission of severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2),” *J Hosp Infection*, Jan 12, 2021, [https://www.journalofhospitalinfection.com/article/S0195-6701\(21\)00007-4/fulltext](https://www.journalofhospitalinfection.com/article/S0195-6701(21)00007-4/fulltext)
 - c. Jones, R., “Droplets, aerosols and COVID-19: updating the disease transmission paradigm,” OUPblog, Jan 11, 2021, <https://blog.oup.com/2021/01/droplets-aerosols-and-covid-19-updating-the-disease-transmission-paradigm/>.
 - d. Jarvis, M.C., “Aerosol Transmission of SARS-CoV-2: Physical Principles and Implications,” *Front Public Health*, Nov 23, 2020, <https://www.frontiersin.org/articles/10.3389/fpubh.2020.590041/full>
 - e. Prather, K., L.C. Marr, et al., “Airborne transmission of SARS-CoV-2,” *Science*, Oct 16, 2020, <https://science.sciencemag.org/content/370/6514/303.2.full>
 - f. Tang, S., Y. Mao, et al., “Aerosol transmission of SARS-CoV-2? Evidence, prevention and control,” *Environ Int*, Aug 7, 2020 <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7413047/>
 - g. Milton, D. “A Rosetta Stone for Understanding Infectious Drops and Aerosols,” *J Pediatric Infectious Diseases Society*, July 24, 2020 <https://academic.oup.com/jpids/article/9/4/413/5875939>
 - h. Morawska, L. and D.K. Milton, “It Is Time to Address Airborne Transmission of Coronavirus Disease 2019 (COVID-19),” *Clinical Infectious Diseases*, July 6, 2020, <https://academic.oup.com/cid/article/71/9/2311/5867798?login=true>
 - i. Zhang, R., Y. Li, et al., “Identifying airborne transmission as the dominant route for the spread of COVID-19,” *Proceedings of the National Academy of Sciences*, June 30, 2020, <https://www.pnas.org/content/117/26/14857>
 - j. Dancer, S.J., J.W. Tang, et al., “Putting a balance on the aerosolization debate around SARS-CoV-2,” *J Hospital Infection*, May 13, 2020, <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7219351/>
 - k. Marr, L. and J. Jimenez, “Bibliography on Transmission of COVID-19,” (unpublished), July 3, 2020, https://docs.google.com/document/d/13s6QyHyF6Pqfr2_R_4ilmzmjYHRmrWE0EzwHvxvyRL4/edit?usp=sharing.

CDC Has Not Fully Recognized Aerosol/Airborne Transmission of SARS-CoV-2

In its Covid-19 guidance, the CDC continues to maintain the outdated paradigm of a divide between “droplet” and “airborne.” This paradigm must be updated based on decades of research on aerosol transmission in order for the CDC’s Covid-19 guidance to be protective.

- 1. The CDC maintains that Covid-19 is spread through “close contact” and downplays the risk for airborne/aerosol transmission.**
 - a. FAQs- Spread: “COVID-19 is thought to spread mainly through close contact from person to person, including between people who are physically near each other (within about 6 feet).”³⁵
 - b. How COVID-19 Spreads: “When people with COVID-19 cough, sneeze, sing, talk, or breathe they produce respiratory droplets. These droplets can range in size from larger droplets (some of which are visible) to smaller droplets. Small droplets can also form particles when they dry very quickly in the airstream. Infections occur mainly through exposure to respiratory droplets when a person is in close contact with someone who has COVID-19. Respiratory droplets cause infection when they are inhaled or deposited on mucous membranes, such as those that line the inside of the nose and mouth. As the respiratory droplets travel further from the person with COVID-19, the concentration of these droplets decreases. Larger droplets fall out of the air due to gravity. Smaller droplets and particles spread apart in the air.”³⁶
 - c. How COVID-19 Spreads: “Covid-19 can sometimes be spread by airborne transmission” This section includes some statements that are correct. However, the CDC downplays the potential for and role of airborne/aerosol transmission.³⁷
 - i. “There is evidence that *under certain conditions*, people with COVID-19 seem to have infected others who were more than 6 feet away. These transmissions occurred within enclosed spaces that had inadequate ventilation. Sometimes the infected person was breathing heavily, for example while singing or exercising.”³⁸ [italics added for emphasis]
 - ii. The CDC refocuses on “close contact,” which appears to be a new term to describe the traditional concept of droplet transmission: “Available data indicate that it is much more common for the virus that causes COVID-19 to

³⁵ U.S. Centers for Disease Control and Prevention, “COVID-19 Frequently Asked Questions: Spread,” last updated March 17, 2021, <https://www.cdc.gov/coronavirus/2019-ncov/faq.html#Spread>.

³⁶ U.S. Centers for Disease Control and Prevention, “How COVID-19 Spreads,” last updated Oct 28, 2020, <https://www.cdc.gov/coronavirus/2019-ncov/prevent-getting-sick/how-covid-spreads.html>.

³⁷ Ibid.

³⁸ Ibid.

spread through close contact with a person who has COVID-19 than through airborne transmission.”³⁹

2. **CDC’s *Science Brief: SARS-CoV-2 and Potential Airborne Transmission*⁴⁰ makes weak and faulty arguments that ignore the vast body of evidence regarding aerosol transmission and retrench into the droplet paradigm. This brief must be updated.**

- a. CDC states that “Airborne transmission is not equally efficient for all respiratory microbes,” and, “Diseases that are spread efficiently through airborne transmission tend to have high attack rates because they can quickly reach and infect many people in a short period of time.”⁴¹ CDC is implying that because SARS-CoV-2 is not as contagious as “true” airborne pathogens like measles and tuberculosis, it is not truly airborne.
 - i. But this is faulty reasoning. There are many factors that play into how contagious an infectious disease is/how efficiently it spreads through airborne transmission, including the amount of pathogen emitted by infected person and infectious dose. If airborne transmission is possible, then it is possible, and the CDC needs to fully recognize it and incorporate effective prevention measures into all their guidance.
 - ii. Tang et al. provide a lucid analysis of this “myth” in their paper (see Myth 4).⁴²
- b. The CDC recognizes that “airborne transmission of SARS-CoV-2 can occur *under certain circumstances*.”⁴³ [italics added for emphasis] The emphasized text serves to downplay the role of airborne/aerosol transmission in the spread of Covid-19. If airborne transmission can occur for this virus, why does CDC resist fully acknowledging it? Why does CDC bury ventilation at the bottom of guidance and exclude respiratory protection in some guidance, focusing instead on wearing masks and keeping physical distance?

3. CDC guidance often references the *2007 Guideline for Isolation Precautions: Preventing Transmission of Infectious Agents in Healthcare Settings*, which clearly (and

³⁹ Ibid.

⁴⁰ U.S. Centers for Disease Control and Prevention, “Science Brief: SARS-CoV-2 and Potential Airborne Transmission,” last updated Oct 5, 2020, <https://www.cdc.gov/coronavirus/2019-ncov/science/science-briefs/scientific-brief-sars-cov-2.html>.

⁴¹ Ibid.

⁴² Tang, J.W., W.P. Bahnfleth, et al., *Journal of Hospital Infection*, Jan 12, 2021.

⁴³ U.S. Centers for Disease Control and Prevention, “Science Brief: SARS-CoV-2 and Potential Airborne Transmission,” last updated Oct 5, 2020, <https://www.cdc.gov/coronavirus/2019-ncov/science/science-briefs/scientific-brief-sars-cov-2.html>.

problematically) lays out the “droplet vs airborne” paradigm.⁴⁴ This guideline must also be updated to reflect the body of scientific literature on aerosol transmission.

Fully Recognizing Aerosol Transmission of Covid-19 Means Updating Guidance for Health Care and Other Industries

To fully recognize aerosol transmission, CDC needs to update its Covid-19 guidance for health care and other industries. This section details what those changes would be for the CDC’s health care Covid guidance.

1. The CDC must update its infection control guidance for health care settings to recognize aerosol transmission of SARS-CoV-2:

- a. The CDC must delete the “optimization strategies” for N95 respirators and other PPE. These guidelines were never based on science. These crisis and contingency standards allow employers to refuse nurses the respiratory protection they need to care for Covid patients safely, including policies that restrict N95 respirator use for aerosol-generating procedures only, policies that require use of surgical masks for routine patient care for Covid patients, policies that require extended use and reuse of N95 respirators and other single-use PPE. Health care employers use these guidelines to rationalize policies that place nurses, health care workers, and their patients at risk of Covid-19.
 - i. Delete “Optimizing Personal Protective Equipment (PPE) Supplies,” <https://www.cdc.gov/coronavirus/2019-ncov/hcp/ppe-strategy/index.html> and all guidance in this section.
 - ii. Delete “N95 and Other Respirators,” <https://www.cdc.gov/coronavirus/2019-ncov/hcp/n95-other-respirators.html> and all guidance in this section.
 - iii. Delete “Strategies for Optimizing the Supply of N95 Respirators,” updated Feb 10, 2021, <https://www.cdc.gov/coronavirus/2019-ncov/hcp/respirators-strategy/index.html>.
 - iv. Delete “optimization strategies” for other types of PPE, including:
 1. Facemasks: <https://www.cdc.gov/coronavirus/2019-ncov/hcp/ppe-strategy/face-masks.html>
 2. Eye protection: <https://www.cdc.gov/coronavirus/2019-ncov/hcp/ppe-strategy/eye-protection.html>
 3. Gowns: <https://www.cdc.gov/coronavirus/2019-ncov/hcp/ppe-strategy/isolation-gowns.html>
 4. Gloves: <https://www.cdc.gov/coronavirus/2019-ncov/hcp/ppe-strategy/gloves.html>

⁴⁴ U.S. Centers for Disease Control and Prevention, “2007 Guideline for Isolation Precautions: Preventing Transmission of Infectious Agents in Healthcare Settings,” last updated July 2019, <https://www.cdc.gov/infectioncontrol/pdf/guidelines/isolation-guidelines-H.pdf>.

- b. Strengthen the “Interim Infection Prevention and Control Recommendations for Healthcare Personnel During the Coronavirus Disease 2019 (COVID-19) Pandemic,” updated Feb 23, 2021, <https://www.cdc.gov/coronavirus/2019-ncov/hcp/infection-control-recommendations.html>, including:
 - i. Strengthen and prioritize recommendations on ventilation to reduce the spread of SARS-CoV-2 in health care facilities, including strengthening recommendations to place patients with confirmed or suspected Covid-19 in airborne infection isolation rooms (AIIRs) and converting areas of the facility to negative pressure, and including strengthening recommendations to prevent recirculation of air containing infectious viral particles in non-AIIR spaces, including both patient and non-patient care areas.
 - ii. Strengthen recommendations on screening, isolating, and cohorting patients with confirmed and suspected Covid-19. Given the high rate of transmission from asymptomatic and pre-symptomatic cases, all patients must be screened for Covid-19 using reliable diagnostics tests, questions about recent exposure history, as well as symptom screening. Currently, the CDC guidance focuses on symptom screening, which is insufficient, and does not provide strong recommendations on isolating patients who may have Covid-19. The CDC must add clear recommendations that confirmed and suspected Covid patients should be cohorted; mixed units (where both Covid-positive and non-Covid patients are placed) and mixed assignments (where a nurse is assigned both Covid-positive and non-Covid patients) place staff and patients at increased risk of Covid-19.
 - iii. Strengthen recommendations for use of respiratory protection by health care workers caring for patients who have not been fully screened for Covid-19, including recent exposure history. Just because a patient does not have symptoms matching Covid-19 does not mean they are not infectious. Similarly, just because a patient tests negative on a diagnostic test does not mean they are not infectious. The CDC must reorient their infection control guidance with a precautionary approach that provides optimal protections to health care workers.
 - iv. Delete the crisis standards that allow employers to return asymptomatic exposed and asymptomatic positive workers to work if “staffing needs” require: <https://www.cdc.gov/coronavirus/2019-ncov/hcp/return-to-work.html> and <https://www.cdc.gov/coronavirus/2019-ncov/hcp/mitigating-staff-shortages.html>
2. **The CDC must rewrite its definition of “exposure” that warrants precautionary removal from the workplace in order to recognize aerosol transmission in “Interim U.S. Guidance for Risk Assessment and Work Restrictions for Healthcare Personnel**

with Potential Exposure to SARS-CoV-2,” updated March 11, 2021,
<https://www.cdc.gov/coronavirus/2019-ncov/hcp/guidance-risk-assesment-hcp.html>.

- a. The introductory section of this guidance must be removed entirely. The CDC currently tells health care employers that “The feasibility and utility of performing contact tracing of exposed HCP and application of work restrictions depends upon the degree of community transmission of SARS-CoV-2 and the resources available for contact tracing.” The CDC essentially lets employers off the hook completely from conducting contact tracing. Contact tracing is essential to preventing transmission of Covid-19 in health care facilities.
 - b. The equivalency between face masks and respirators in determining whether a health care worker has been exposed must be deleted (row 1 of the table in this guidance). Face masks and respirators are not equivalent levels of protection. Transmission even with the use of face masks and surgical masks has been documented multiple times.
 - i. Goldberg, L., Y. Levinsky, et al., “SARS-CoV-2 Infection Among Health Care Workers Despite the Use of Surgical Masks and Physical Distancing—the Role of Airborne Transmission ,” *Open Forum Infectious Diseases*, Jan 27, 2021, <https://academic.oup.com/ofid/advance-article/doi/10.1093/ofid/ofab036/6121257>.
 - ii. Klompas, M., M.A. Baker, et al., “A SARS-CoV-2 Cluster in an Acute Care Hospital,” *Annals of Internal Medicine*, Feb 9, 2021, <https://www.acpjournals.org/doi/full/10.7326/M20-7567>.
 - iii. Pringle, J.C., J. Leikauskas, et al., “COVID-19 in a Correctional Facility Employee Following Multiple Brief Exposures to Persons with COVID-19 — Vermont, July–August 2020,” *MMWR Early Release*, Oct 30, 2020, <https://www.cdc.gov/mmwr/volumes/69/wr/mm6943e1.htm>.
 - c. The CDC’s criteria for “close contact”—15 minutes of contact cumulative over a 24-hour period within six feet of a Covid case—is arbitrary. Transmission in less than 15 minutes and at greater than six feet has been documented (see prior sections). This definition must be rewritten to better reflect considerations based on time and distance in addition to other protective measures, including ventilation, respiratory protection, and other PPE.
- 3. CDC must also strengthen guidance for other industries to better recognize aerosol transmission of this virus, including improving guidance on ventilation measures and respiratory protection for workers with potential exposure to the coronavirus. Protecting workers is fundamental to an effective response to this pandemic.**

Employers Claim that Health Care Workers are More Often Infected from Community Exposures than from Patient Care Exposures—the CDC Must Stop Enabling and Perpetrating This Harmful and False Narrative

The CDC funded a study that was published in JAMA recently⁴⁵ that perpetuates the health care industry narrative that health care workers are infected more often from community exposures than from patient care exposures. This narrative, which has been published in multiple papers without supporting evidence, is harmful, intellectually bankrupt, epistemologically flawed, and willfully neglects the empirical reality of conditions in health care facilities over the past year. The CDC must stop perpetrating this narrative.

When employers say health care workers are more likely to be infected in the community than during patient care, they are, in effect, blaming health care workers for workplace exposures and infections.

The fact of the matter is that nurses and health care workers have not had and still do not have the protections they need to care for Covid-19 patients safely.

There is insufficient data regarding health care worker infections and outbreaks within health care facilities. The CDC still reports that only a small fraction (18.32 percent) of Covid case reports have any data on whether the individual was a health care worker.⁴⁶ There are likely more outbreaks than we have known about.

Some employers say they have data that indicates that staff infections happen in break rooms and community settings, but little of that data has been shared publicly and there is a common flaw in the data that has been shared:

Employers use the CDC's definition of exposure, but this definition denies science and is constructed in such a way that it allows health care employers to avoid tracking and recording exposures and infections that happen in the workplace:

1. The CDC says:⁴⁷ A health care provider should be excluded from work for 14 days if they have had prolonged close contact (15 min within six feet) with a person with confirmed COVID-19 IF:
 - a. The health care provider was not wearing a respirator or facemask;
 - b. The health care provider was not wearing eye protection if the person with COVID-19 was not wearing a face covering; or

⁴⁵ Jacob, J.T., J.M. Baker, et al., "Risk Factors Associated With SARS-CoV-2 Seropositivity Among US Health Care Personnel," JAMA, March 10, 2021, <https://jamanetwork.com/journals/jamanetworkopen/fullarticle/2777317>.

⁴⁶ U.S. Centers for Disease Control and Prevention, "COVID Data Tracker: Cases & Deaths among Healthcare Personnel," updated March 30, 2021, <https://covid.cdc.gov/covid-data-tracker/#health-care-personnel>.

⁴⁷ U.S. Centers for Disease Control and Prevention, "Interim U.S. Guidance for Risk Assessment and Work Restrictions for Healthcare Personnel with Potential Exposure to SARS-CoV-2," updated March 11, 2021, <https://www.cdc.gov/coronavirus/2019-ncov/hcp/guidance-risk-assesment-hcp.html>.

- c. The health care provider was not wearing all recommended PPE (gown, gloves, eye protection, respirator) while performing an aerosol-generating procedure.
2. But we know that:
- a. A definition of exposure should not be contingent on an arbitrary 15-minute timeframe. There are multiple reports of infections that occurred with exposures less than 15 minutes.^{48,49,50,51}
 - b. A definition of exposure should not be contingent on an arbitrary six-foot distance. Covid-19 is transmitted via infectious aerosols emitted when people who are infected breathe, speak, cough, sneeze, sing, or have aerosol-generating procedures performed. These aerosols range from very small to large and can travel long distances (up to about 25 feet) and stay suspended in the air.⁵²
 - c. A facemask does NOT provide adequate protection from Covid-19. Infectious aerosols can travel around and through a facemask.⁵³ Transmission has been documented in a pediatric hospital in Israel⁵⁴ and in a Vermont correctional facility⁵⁵ even where surgical masks and physical distancing measures were observed. A respirator at least as protective as an N95, in addition to other PPE, is necessary to protect nurses and health care workers from Covid-19.

The CDC must update their definition of exposure to better reflect the available scientific evidence (see above for more details).

The bottom line is—employers have a legal and moral obligation to provide a safe and healthful workplace to employees.⁵⁶ But we know that many health care employers have neglected this duty throughout the Covid-19 pandemic. Many health care employers have used CDC guidance as the rationale for withholding respirators and other protections for nurses and health care workers.

⁴⁸ Pringle et al., MMWR Early Release, October 2020.

⁴⁹ de Oliveira et al., “Evolution of spray and aerosol from respiratory releases: theoretical estimates for insight on viral transmission,” Proceedings of the Royal Society A: Mathematical, Physical and Engineering Sciences, January 2021. <https://doi.org/10.1098/rspa.2020.0584>

⁵⁰ Mack et al., “Implementation and Evolution of Mitigation Measures, Testing, and Contact Tracing in the National Football League, August 9–November 21, 2020,” MMWR Early Release, January 2021. https://www.cdc.gov/mmwr/volumes/70/wr/mm7004e2.htm?s_cid=mm7004e2_w

⁵¹ Kwon et al., “Evidence of Long-Distance Droplet Transmission of SARS-CoV-2 by Direct Air Flow in a Restaurant in Korea,” Journal of Korean Medical Science, November 2020. <https://jkms.org/DOIx.php?id=10.3346/jkms.2020.35.e415>

⁵² See first section in this document for studies on this point.

⁵³ Oberg and Brosseau, “Surgical mask filter and fit performance,” Am J Infect Control, 2008, 36(4): 276-82, <https://pubmed.ncbi.nlm.nih.gov/18455048/>.

⁵⁴ Goldberg et al., “SARS-CoV-2 Infection Among Health Care Workers Despite the Use of Surgical Masks and Physical Distancing—the Role of Airborne Transmission,” Open Forum Infectious Diseases, Jan 27, 2021, <https://academic.oup.com/ofid/article/8/3/ofab036/6121257>.

⁵⁵ Pringle, et al., “COVID-19 in a Correctional Facility Employee Following Multiple Brief Exposures to Persons with COVID-19 — Vermont, July–August 2020,” MMWR Early Release, Oct 21, 2020, <https://www.cdc.gov/mmwr/volumes/69/wr/mm6943e1.htm>.

⁵⁶ 29 USC §654

Table 1 outlines the measures health care employers should implement to protect nurses, health care workers, and patients from Covid-19. Support scientific literature for the effectiveness of each measure is listed in the left column. In the right column, results from National Nurses United’s most recent survey of nurses across the nation are listed. These survey results demonstrate that employers continue to fail to protect nurses over a year into this pandemic.

| Table 1: Employers Continue to Neglect Proven Measures to Protect Nurses and Health Care Workers, Exposing Them to Covid-19 at Work. | |
|---|---|
| Infection Control Measures to Prevent Transmission of Covid-19 in Health Care Facilities and Supporting Scientific Research | NNU’s Most Recent Feb 2021 Covid-19 Survey of Nurses Shows Continued Failure of Employers to Prevent Occupational Covid-19 Exposures⁵⁷ |
| Dedicated Units for Covid and non-Covid patients (no mixed units, no mixed assignments) <i>Chen et al., Anesthesia & Analgesia, July 2020.</i> <i>Glasbey et al., J Clinical Oncology, Oct 2020.</i> <i>Liu et al., Frontiers in Public Health, Oct 2020.</i> | Hospitals and other health care facilities mix Covid-19, suspected Covid-19, and non-Covid-19 patients. <ul style="list-style-type: none"> • Only 66 percent of RNs who work in hospitals report that their facility has a dedicated Covid unit or area. |
| Screening All Patients for Covid-19 (symptom screening, testing, and recent exposure history) <i>Burns et al., J Hospital Infection, Nov 2020.</i> <i>Khonyongwa et al., J Hosp Inf, Oct 2020.</i> <i>Piapan et al., J Hosp Inf, Aug 2020.</i> <i>Touati et al., J Hosp Inf, July 2020.</i> | Hospitals and other health care facilities do not effectively screen patients for Covid-19. Given that approximately 50 percent of transmission is from asymptomatic or presymptomatic infections, all patients, regardless of symptoms, should be considered potentially infected with Covid-19. <ul style="list-style-type: none"> • Only 52 percent of RNs who work in hospitals report that all patients are screened for Covid-19. |
| Optimal Personal Protective Equipment (PPE) <i>Bhaskar & Arun, JAMA, Aug 2020.</i> <i>Chin et al., Anesthesia & Analgesia, July 2020.</i> <i>Feldman et al., JAMA, April 2020.</i> <i>Hou et al., Precision Clinical Medicine, July 2020.</i> <i>Jung, Jiwon et al., Journal of Infection, June 2020.</i> <i>Marago, Italo and Isa Minen, Lancet, July 2020.</i> <i>Nguyen et al., The Lancet Public Health, July 2020.</i> <i>Oksanen et al., medRxiv, Aug 2020.</i> <i>Park et al., J Hosp Infection, Oct 2020.</i> <i>Tong et al., Immun Inflamm Dis, Aug 2020.</i> <i>Wang, H et al., J Hospital Infection, April 2020.</i> <i>Wang, Wei et al., medRxiv, April 2020.</i> | Employers are not providing nurses and health care workers with the necessary PPE to do their jobs safely. <ul style="list-style-type: none"> • 81 percent of nurses report they still reuse at least one type of single-use PPE. • This is practically unchanged from NNU’s November 2020 study that found that more than 80 percent of nurses reported reusing at least one type of single-use PPE. |

⁵⁷ National Nurses United, “National RN survey highlights continued hospital failures to prioritize nurse and patient safety during pandemic,” March 10, 2021, <https://www.nationalnursesunited.org/press/fifth-survey-of-national-nurses-highlights-continued-hospital-failures>.

| | |
|---|--|
| <p><i>Wang, Xinghuan et al., J Hospital Infection, Mar 2020.</i> <i>Xue, Ming et al., Hospital Practice, July 2020.</i> <i>Zhan et al., AJIC, Aug 2020.</i> <i>Zhu & Zong, QJM An Int Journal of Medicine, Aug 2020.</i></p> | |
| <p>Testing for Nurses and Health Care Workers (after exposure and weekly for surveillance)</p> <p><i>Chin et al., Clin Infect Dis, Oct 2020.</i></p> | <p>Nurses are not getting tested and are not being informed in a timely manner when they are exposed to Covid-19 at work.</p> <ul style="list-style-type: none"> • Only 54 percent of RNs report that they have ever been tested for Covid-19. • Less than a third (32 percent) of hospital RNs report that their employer informs them of exposures in a timely manner. |
| <p>Staffing</p> <p><i>Maltezou et al., Journal of Hospital Infection, Oct 2020.</i> <i>Kim et al., NEJM Catalyst, June 2020.</i></p> | <p>Short staffing was an issue for many nurses before the pandemic; now, employers are using the pandemic as an excuse to cut corners and short staffing is at crisis levels.</p> <ul style="list-style-type: none"> • 53 percent of nurses report that short staffing is their top safety concern. • Nearly half of hospital nurses report that staffing has gotten slightly or much worse recently. • In addition, 26 percent of nurses report being reassigned to units where new skills or competencies are required, without adequate training. |

Studies, including the CDC-funded study published in JAMA recently, that perpetrate this harmful and false narrative that health care workers are more likely to be infected due to community exposures than patient care exposures have serious, multiple methodological issues.

1. Methodological issues with CDC-funded study published in JAMA:⁵⁸

- a. The authors essentially make a causal claim based on cross-sectional, population-based data.
- b. The study’s hypothesis was an a priori hypothesis that stated: “that community exposure but not health care exposure was associated with seropositivity.” This is problematic because the researchers are beginning their research with the assumption that exposure happens in the community, thereby analyzing toward that result. If the hypothesis were stated the other way around, i.e., it happens in

⁵⁸ Jacob, J.T., J.M. Baker, et al., JAMA, March 10, 2021, <https://jamanetwork.com/journals/jamanetworkopen/fullarticle/2777317>.

the healthcare setting, analysis would lean toward that result. Such an a priori hypothesis could lead to confirmation bias.

The researchers write that, “Most HCP (20 072 [81.1%]) reported no known contact with a person confirmed or suspected of having COVID-19 in their community” (page 6). But, further on the same page, they write, “Half of HCP (12 413 [50.2%]) reported caring for patients with COVID-19 or working in COVID-19–designated units.” We receive no discussion on this.

This points to confirmation bias. The study’s regression model results do not discuss this discrepancy, given that they write: “HCP who reported having contact with a person known to have or suspected of having COVID-19 in the community had substantially increased odds of seropositivity compared with HCP with no known COVID-19 contacts outside of work (aOR, 3.5; 95% CI, 2.9-4.1). Zip code–based COVID-19 cumulative incidence (log 10) was also associated with increased odds of seropositivity (aOR, 1.8; 95% CI, 1.3-2.6),” (page 7).

- c. The study relies on seropositivity as a perfect indicator of past infection.
 - i. This is despite the fact that we know antibody levels fade in many individuals- one study found that 60 percent of health care workers became sero-negative within 60 days after testing positive for antibodies.⁵⁹
 - ii. The study collected data on seropositivity from April to August 2020- a time period over which a proportion of health care workers may have converted from seropositivity to sero-negativity.
 - iii. Further, researchers relied on the serology testing at each particular site, rather than using a standardized serology test. This is problematic because, as the authors point out, laboratory methods differed across sites and could result in different overall positivity rates than would have been estimated if methods were standardized across sites.

- d. Exposure measurement was inaccurate and flawed.
 - i. Questionnaires were not standardized across study sites. The researchers write, “In addition, we were unable to assess risk associated with exposure to an HCP with SARS-CoV-2 infection in the workplace because not all sites asked about such exposures” (page 11). But that is the whole point of the study.
 - ii. According to the study, “Each site independently designed and conducted a voluntary HCP serological survey... At the time of specimen collection, HCP completed a site-specific survey, including occupational activities and possible exposures to individuals with SARS-CoV-2 infection both inside and outside the workplace.” This is problematic because exposure

⁵⁹ Patel, M.M., N.J. Thornburg, et al., “Change in Antibodies to SARS-CoV-2 Over 60 Days Among Health Care Personnel in Nashville, Tennessee,” JAMA, Sept 17, 2020, <https://jamanetwork.com/journals/jama/fullarticle/2770928>.

answers were self-reported. It is entirely probable that a healthcare professional was exposed at work, but was never informed – whether because a patient or visitor was asymptomatic or because it was assumed the professional had not been in direct contact with the positive individual.

- iii. Because the questionnaires were not standardized, the researchers only included risk factors in the multivariable model that were able to be mapped from all sites. Thus, if a risk factor was not present in all questionnaires, it was excluded from the model (pages 10-11). This is a significant methodological problem because some of these risk factors could alter the findings dramatically. Moreover, the researchers only provided two examples of such instances (see below), but we do not know how many of these instances there were. Thus, a lot of what was not mapped could hold significant information regarding exposure in the workplace and, again, could alter the findings dramatically.
 1. Example 1: The researchers were unable to assess risk associated with participation in aerosol-generating procedures because these data were only available from three of the four health care system surveys. But this is a key way that Covid-19 could be spread.
 2. Example 2: Because infection control practices were not standardized across all sites and the practices changed during the study period, researchers did not assess the association of specific infection control practices with seropositivity rates. But such practices, or lack thereof, is exactly how and why Covid-19 is spreading in healthcare settings.
 3. In reference to Example 2, the researchers write, “however, we did observe similar HCP seropositivity rates despite institutional differences in personal protective equipment guidelines,” but this is not the same thing as looking at infection control practices.
- iv. The way the study measured community exposure was to take zip codes where healthcare workers lived and to assign them a level of community exposure, with no regard to individual risks except self-reported close contact with a known Covid case. More Covid in the community means more Covid patients in the hospital, which means more exposure to healthcare workers at work; but this is not accounted for in this study.
- e. The researchers grouped staff with patient contact and no patient contact into the same categories: “Workplace location was categorized as emergency department, inpatient (regardless of direct care of patients with COVID-19), other locations (ambulatory, perioperative, surgical, rehabilitation or postacute care, no patient contact, worked from home), or unknown location.”
- f. The way the researchers combined data from different facilities and conducted their statistical analysis hides differences in infection control practices between

facilities, including ventilation, patient screening and placement, and other factors that impact exposure risk to nurses and health care workers. They reported on limited information about PPE policies at these facilities in the appendix but reuse of N95s, which we know has been and continues to be widespread, is not discussed.

- g. The researchers found that those younger than 30 years (nearly 20 percent of surveyed health care workers) had slightly increased risk of seropositivity. The researchers assume this is because, “Younger HCP may be more likely to congregate in groups socially, have children in school or daycare, and have contact with other younger persons who may have fewer symptoms with infection.” But this result may be due to other factors, such as how the survey was handed out or disseminated. Moreover, the text about gathering in groups and daycare highlight the study’s confirmation bias. The authors offered no evidence to support these assertions.
- h. The researchers write that, “We found that the higher the cumulative incidence of COVID-19 until the week prior to the antibody test, the higher the risk of the HCP being antibody positive,” (page 13). But it is reasonable to conclude that if the community has a higher rate, than the hospitals and healthcare settings have higher volumes of positive patients. Thus, the healthcare provider could have reasonably caught Covid-19 at work. This discrepancy is not accounted for in the researchers’ analysis.

2. Methodological issues with other publications perpetuating industry narrative blaming nurses and health care workers for exposures and infections.

a. Methodological issues in a study published by the CDC in their Morbidity and Mortality Weekly Report (MMWR):⁶⁰

- i. The study appears to cover only 9 percent (373) of the known healthcare worker infections in Minnesota reported by mid-July (4,232).⁶¹ Extrapolation from that 9 percent is irresponsible and misguided.
- ii. Minnesota Department of Health’s website lists UNKNOWN source of infection as far and away the largest source of infections.⁶² How is it that

⁶⁰ Fell et al., “SARS-CoV-2 Exposure and Infection Among Health Care Personnel — Minnesota, March 6–July 11, 2020,” MMWR, 69(43): 1605-10, Oct 30, 2020.

⁶¹ Minnesota Department of Health, WEEKLY COVID-19 REPORT 12/10/2020, <https://www.health.state.mn.us/diseases/coronavirus/stats/covidweekly50.pdf>, accessed 12/15/20; Minnesota Department of Health, WEEKLY COVID-19 REPORT 7/16/2020

<https://www.health.state.mn.us/diseases/coronavirus/stats/covidweekly29.pdf>, accessed 12/15/20.

⁶² Minnesota Department of Health, WEEKLY COVID-19 REPORT 12/10/2020, <https://www.health.state.mn.us/diseases/coronavirus/stats/covidweekly50.pdf>, accessed 12/15/20; Minnesota

the sources of healthcare worker infections appear to be completely accounted for (work-related vs. non-work-related) in the publication and in the weekly reporting (here they are referred to as “likely exposures”)?⁶³ How is it that in the specific case of health care workers there are suddenly no unknowns? In the absence of full-scale genetic testing, it is an absurdity to suggest the state or hospital industry can know with any certainty the source of infection for healthcare workers, while simultaneously admitting the main source of infection is unknown for the state’s population as a whole.

- iii. The authors lump exposures to coworkers together with household and social contacts as “non patient care interactions” to make their conclusions. However, interacting with coworkers is a necessary and important part of providing health care- both in break rooms and in the course of providing care. It is deceptive and inappropriate to lump these exposures into the same category.
- iv. Of the higher-risk exposures, the MMWR indicates that 19 percent of health care providers were infected from outside of work setting, “household/social.” That means that 81 percent were infected at work, which seems like an overwhelmingly large percentage.
- v. The authors lump exposures from coworkers together with those from households and social contacts as “nonpatient care interactions,” and thus make the statement that only 66 percent of exposures involved direct patient care. Interacting with coworkers is a basic and necessary part of providing patient care. While certainly not all coworker interactions happen while providing direct patient care, they all happen as a part of the provision of patient care. To put exposures from coworkers into the same category as community exposures seems illogical and deceptive.
- vi. The authors do not separate out health care provider occupations, rather lumping together job titles with frequent patient contact (such as nurses) with many other job titles who do not have patient contact (clerical staff, engineering and facilities management, and administrative and billing staff).
- vii. The authors report symptom-based testing, meaning they could have missed up to half of all true infections following exposures.

Department of Health, WEEKLY COVID-19 REPORT 7/16/2020
<https://www.health.state.mn.us/diseases/coronavirus/stats/covidweekly29.pdf>, accessed 12/15/20.

⁶³ Minnesota Department of Health, WEEKLY COVID-19 REPORT 7/16/2020
<https://www.health.state.mn.us/diseases/coronavirus/stats/covidweekly29.pdf>, accessed 12/15/20.

- viii. Additionally, given the lack of testing of health care workers in general, and the large proportion of likely Covid-positive individuals who are asymptomatic and never tested, there is always a possibility that a healthcare worker was infected at work, regardless of other exposures. See NNU survey results.⁶⁴
- ix. In fact, the MMWR gives a sense of the outrageously minimal level of testing for health care providers: Overall, only 30 percent of health care providers with higher-risk exposures were tested, and barely one in four were tested in acute settings. The numbers are likely even lower for those with less than “higher-risk” exposures.
- x. The report relies upon the CDC’s definition of exposure, which treats a face mask as the same as a respirator. We know it is not. However, the CDC’s definition of exposure rejects this scientific evidence and muddies the waters on interpreting this exposure data.
 - 1. The study only looks at 25 percent of reported health care worker exposures. As the remaining unexamined exposures are of a lower-risk type, they are likely different than the ones discussed in the report and may or may not be more concentrated in patient care settings. There is plenty of evidence at this point indicating that lower-risk exposures can lead to infection spread.
 - 2. Data on higher risk exposures is self-reported from the healthcare facilities: Hospitals and other facilities have an interest in not reporting exposures, especially those occurring in patient care and work settings, as they may be concerned about losing workers through quarantine requirements or future liability issues. This dynamic can lead to a distortion of the data.
- xi. Reporting does not include all facilities, some participating facilities did not submit data, and some exposed workers did not participate in the monitoring. Those facilities not submitting reports may not be complying with infection control recommendations at the same levels as those that are reporting. It may be worth looking into what proportion of facilities were not involved in the study, and how many exposed workers were not accessed. Are there any differences in that portion of the workforce from the one that is included in this study?

⁶⁴ National Nurses United, “National RN survey highlights continued hospital failures to prioritize nurse and patient safety during pandemic,” March 10, 2021, <https://www.nationalnursesunited.org/press/fifth-survey-of-national-nurses-highlights-continued-hospital-failures>.

- b. **Cleveland Clinic** made statements in the media that health care workers were infected because of community exposures but offered no supporting evidence.⁶⁵ Further, Cleveland Clinic announced later that the N95 respirators they had been providing to their staff were counterfeit and did not offer sufficient protection.⁶⁶ These counterfeit, faulty respirators were provided to staff during the same time period as the high number of Covid cases among the staff, and yet the Cleveland Clinic has not acknowledged this significant workplace exposure to staff that occurred at the same time the employer claimed staff were infected in the community.

- c. See also the updated **Sins of Omission Report** from National Nurses United.⁶⁷

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⁶⁵ Justice, C., “Northeast Ohio healthcare workers getting COVID from community spread, Cleveland Clinic doctor says,” News 5 Cleveland, Nov 9, 2020, <https://www.news5cleveland.com/news/continuing-coverage/coronavirus/local-coronavirus-news/northeast-ohio-healthcare-workers-getting-covid-from-community-spread-cleveland-clinic-doctor-says>.

⁶⁶ Fields, C., “Cleveland Clinic finds portion of its N95 masks were counterfeit and not effective,” Cleveland.com, Jan 27, 2021, <https://www.cleveland.com/coronavirus/2021/01/cleveland-clinic-finds-portion-of-its-n95-masks-were-counterfeit-and-not-effective.html>.

⁶⁷ National Nurses United, “Sins of Omission: How Government Failures to Track Covid-19 Data Have Led to more Than 3,200 Health Care Worker Deaths and Jeopardize Public Health,” March 2021, https://www.nationalnursesunited.org/sites/default/files/nnu/documents/0321_Covid19_SinsOfOmission_Data_Report.pdf.