



Covid-19 Risk Management-A Researcher's Perspective

Jeffrey Siegel PhD

This week we start a series of shows from different perspectives on COVID-19 Risk Mitigation. We start with Dr. Jeff Siegel a Professor in the Department of Civil Engineering and the Dalla Lana School of Public Health at The University of Toronto. Prior to accepting his current position, he was an Associate Professor at the University of Texas, Austin. His interests and research have focused on healthy and sustainable buildings, ventilation and indoor air quality in residential and commercial buildings, control of indoor particulate matter, secondary impacts of control technologies and strategies, aerosol dynamics in indoor environments and HVAC systems.

Nuggets mined from today's episode:

COVID in Canada? There are different stories in different places. In late summer Canada was doing quite well and since then things are getting worse. Kids who want to be back in school are back in school. Jeff has concerns over kids being in school. COVID in long term care facilities and among seasonal workers has been a national tragedy. Eastern Canada* has been and is doing the best. [*Eastern Canada is generally considered to be the region of Canada east of Manitoba, consisting of the following provinces: Newfoundland and Labrador New Brunswick Nova Scotia Ontario Prince Edward Island. Wikipedia].

He feels fortunate to be working. Life is different. If we do get back to old normal? Higher education has gone virtual since mid-March. All engineering faculty are teaching online and will likely be online in fall 2021. Anticipates more pre-COVID normalcy in 2022. Student numbers have increased in his grad course from 20+ pre-COVID, to 40+ now. Students are under high stress. Will they get jobs after graduation and when? Employment uncertainty has pushed many students back into grad school

to obtain master's degrees. He hopes students seeking master's degrees in engineering aren't doing so by default. Canada needs to improve underlying issues to provide graduating students with more employment opportunities. Decision making is handled provincially.

Ontario has a conservative government. Big labor fight over class size. Class size has remained the same. 1 meter social distancing. Classes which formerly had 30+ students now have 20+ students. Opines that 1 meter social distancing isn't enough. Physical distancing indoors is fiction. Some particles transport indoors 10x 2 meters. His daughter's school hasn't had a single case of COVID. COVID testing in Ontario isn't horrible but it's not great either. Ontario schools have a 100% mask policy and good adherence to COVID prevention protocols.

What about masks? Jeff has changed his opinion on masks. He felt masks were to protect others from me. Now he considers masks as protection for others against asymptomatic spread. Masks offer some protection for wearers. 3 layer masks are the government standard. As an eyeglass wearer, his glasses fog-up often while wearing a mask.

The role of humidity in infection spread? James Scott coined the phrase, 'nowhere on earth is as dry as the corner of a heated living room'. Large droplets drop fast and settle quickly. Exhaled airborne viral droplets shrink in a fraction of a second after exhalation. Humans are more vulnerable to viruses in low humidity environments. Maintaining 40%-60% RH is important for both comfort and infection reduction. During winter, increasing ventilation by bringing in more outdoor air and then heating it results in very low humidity. In winter, consider dialing back the fresh air ventilation. Improving filtration indoors is a no brainer, either on the HVAC systems or by using portable air cleaners. Portable filtration has been tested and proven effective.

House dust in the great white north? Jeff has conducted a study of filtration in Toronto homes. Every filter possesses some mechanical and static attraction capability. Engineering can improve a filter's mechanical or static action. Duct and furnace cabinet leakage allow filter bypass. A good filter slot is a key component of good filtration. Good filter slot reduces filter bypass. All filters tested declined in performance over time. Rate of decline varied between filter brands. Some performed far less well than when new.

A Finnish filter study on a 70% efficiency filter demonstrated consistent decline in performance over time. After 9 months, 15% efficiency remained.

Filter appearance is one indication of when filter replacement is needed. Filter replacement frequency is dependent upon how long the system operates. Systems in which the fan runs continuously will need filter replacements more often than systems that cycle on and off.

Due to COVID, there is a global shortage of melt blown filter media. We must do better globally on improving supply chain availability of essential materials and goods. Nanofiber fiber filter medias are being developed.

UVC, hydroxyls and plasma, oh my! According to Jeff hydroxyls and plasma are technologies that have not been proven effective satisfactorily. Hydroxyls and plasma have the potential for downside reactions. Jeff wants the technology: proven to work, proven to not cause harm and be proven superior to alternatives. Portable filtration and 'right installation UVC' are the only 2 methods that he deems have been proven effective. 'Right installation' considers UVC compatibility with exposed materials such as in hospitals. UVC is fantastic when installed correctly and risky when used by firms who can't even ensure that a furnace filter has been installed properly.

Jeff has been surprised by what byproducts occur under normal circumstances. He cautions that we don't know what's there until we look for it with the correct instruments. Airborne siloxane from personal care products is known to deposit on electronic precipitators and in the international space station. For example see UC Berkeley siloxane study: <https://www.researchgate.net/publication/282413659> Siloxanes are the most abundant VOC emitted from engineering students in a classroom

Dr Siegel's personal mask choices. In Asia it is a cultural habit to wear a mask whenever experiencing a respiratory problem. Jeff opines, that the world should aspire to this norm. When masks are well done and fitting properly, they provide protection both for wearer and others. Jeff's daily wear mask is a 3 layer cloth with metal nose piece. It fits him pretty well but causes eyeglass fogging. For higher risk environments he uses a 4 layer surgical mask.

He feels that close contact is important in dose response. According to him, long range particle transport has been underplayed. The airborne mode may not be important all the time. He is most concerned about 1-3 micron particles and believes that the dose makes the poison. He personally combines masking with ventilation, filtration and hand washing.

<http://built-envi.com/what-kind-of-mask-should-i-be-wearing-to-protect-against-covid-19/> Brent Stephens article

ASHRAE 62.1? ASHRAE 62.1 is not designed from the infectious disease prevention perspective.

Areas of concern. Jeff is cautious about bathrooms, poorly ventilated rooms with high potential for fecal oral transmission, indirect contact and then touching mucus membranes. We don't know if COVID can survive a trip through the human gastrointestinal tract? He also has concerns about COVID spread through cold fomites in supermarket refrigerators and freezers.

What research would you like to see done?

- Kerry Kinney's filter forensics- viral RNA from filters offers a great opportunity for surveillance especially in mass transit.
- Epidemiologists need to acknowledge and consider the building both during outbreaks and general investigations.
- Merchandising challenges: Energy efficiency has been a poor sell and hasn't garnered interest nor resulted in behavioral change. The significant health dangers of bad IAQ have been a poor sell. Improving cognitive function is an easier sell which includes improving IAQ. Repositioning improving IAQ, to improving cognitive function is an easier sell and provides and combines IAQ with other well perceived benefits. Jeff in conjunction with Mike Mathers will be using an MRI to do neurocognitive brain modeling.

Indoor CO₂ concentrations and cognitive function: A critical review
Bowen Du, Marlie C. Tandoc, Michael L. Mack, Jeffrey A. Siegel

<https://onlinelibrary.wiley.com/doi/abs/10.1111/ina.12706>

Z-Man Signing Off

Root Cause of Odor When Using UVC Disinfection

https://www.uvccleaningsystems.com/cm/dpl/downloads/articles/16/Root_Cause_of_UVC_Odor.pdf

Trivia:

Its indicated that the spillover event introducing humans to SARS-CoV-2 is likely to have occurred in late 2019. When no members of the community are immune and no preventive measures taken, how many new infections do epidemiology studies estimate to occur with each infection?

Answer: 1.4 to 3.9