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COVID accelerated IAQ Research to Practice; What have we learned?

This week on IAQradio+ we welcomed back Dr. Richard Corsi, Dean of the College of Engineering at the University of California, Davis. Many will remember Dr. Corsi for his time at the University of Texas at Austin and Portland State. We had an enlightening discussion with him about his current endeavors and how COVID has accelerated IAQ Research to Practice.

Dr. Richard Corsi recently joined UC Davis as Dean of the College of Engineering. Prior to that he was Dean of the Maseeh College of Engineering and Computer Science at Portland State University and for over 24 years he worked at The University of Texas at Austin where he taught numerous courses related to fluid mechanics, air pollution, and indoor air quality. Dr. Corsi served as Director of a highly-interdisciplinary group that spawned a generation of faculty engaged in research related to indoor air quality. He continues to conduct research on indoor air quality, with foci on physical and chemical processes that affect the fate and control of, and human exposure to, indoor pollutants of both outdoor and indoor origin. Dr. Corsi and his team have published nearly 270 peer-reviewed papers, and he has supervised over 120 students.

Dr. Corsi has been engaged in national discussions related to layered risk reduction to reduce transmission of COVID-19 by aerosol particles. He has been a guest on webinars hosted by the National Academies, USEPA, National Tribal Air Association, and more. In addition, he has done over 100 print, television, and podcast interviews. From early in the pandemic his efforts have focused on lowering inhalation dose of virus-laden aerosol particles indoors. Dr. Corsi led an effort to develop an educational tool for assessing parallel interventions for

lowering inhalation dose for aerosols and risk of infection in buildings. His concept of a low-cost and effective do-it-yourself air cleaner to combat virus-laden aerosol particles and wildfire smoke has become known worldwide as the Corsi-Rosenthal Box.

Nuggets mined from today's show:

In high school Rich Corsi aspired to attend UC Davis as an undergrad and was greatly disappointed when he wasn't accepted. He attended grad school at UC Davis and now he is a Dean in the College of Engineering.

What is your mission at UC Davis? Help the college push boundaries and have a positive impact on society.

UC Davis is a great place with courses in viticulture, a teaching winery on campus, courses on how to make whiskey and design coffee.

Some of Dr. Corsi's thoughts on recent/ongoing advances in indoor air quality research are:

- Wildfire smoke exposure reduction and control continuity
- Role of humans in indoor air pollution
- Role of ozone in creation of ultrafine particles
- Effects of oxidizers on body sprays
- SVOC accumulation in house dust.
- Resuspension of SVOCs leached from plastics and vinyl flooring indoors.
- Ongoing HomeChem studies in Austin, Texas, such as quantification of the effects of cleaning with chlorine compounds (John Abbott, U of Toronto)
- Comparative measurement of respiratory aerosols during different activities
- Effective control technology of filters compared to less effective technologies
- Driving the cost of the Corsi-Rosenthal Box downward, so more people can afford them

30 years ago, Dr. Don Milton demonstrated that aerosol pathway is the primary mechanism for influenza transmission. During the COVID pandemic, Dr. Milton

sounded the alarm about aerosol transmission. Dr. Milton is finally receiving due recognition.

Historical evidence demonstrates that the common cold spreads by a combination of droplet, aerosol and fomites. The quanta generation for colds is lower than the quanta generation rate of COVID-19 or influenza.

COVID outbreak is primarily due to respiratory aerosol emitted by infected individuals and inhaled by those who may become infected.

Universal mask wearing indoors around people you don't know is an inexpensive and effective method to reduce both viral emissions and uptake. A mask that is only 40% efficient in reducing aerosol emissions from an infector and 40% efficient at reducing inhalation of aerosols lades to a combined 64% reduction in the amount of aerosol inhaled by an individual, i.e., relative to infectors and receptor not wearing masks.

After vaccines, masks are the second most effective tool in reducing COVID spread. Richard sought to develop an educational tool for use by schools and modeled the effects of: masks, increased filtration, reduced occupancy that predicts how much a receptor inhales indoors. He applied the model to a restaurant in China. The restaurant had great video and abundant metadata. Dr. Kevin Van Den Wymelenberg and his Ph.D. student Hooman Parhizkar, took the model and added a user interface. Dr. Charles Haas, of Drexel University, added a dose response sub-model. The model demonstrates the effect of layering tactics. It's not so much about avoiding large spittle, far field exposures to respiratory aerosols emitted by an infector can lead to high risk of infection. . https://safeairspaces.com/

1 pico liter is 1 trillionth of a liter.

Aerosol particles are ride-share for the COVID virus'.

When a low cost do-it-yourself air cleaner is made by attaching a single MERV 13 filter to a box fan; resistance is increased and airflow is decreased.

The "Corsi Rosenthal Box" came out of an effort to create a low cost reasonably effective do-it-yourself air cleaner using MERV 13 filters and a box fan. The device

has huge airflow. Efficiency increases with multiple passes. One device can service an 800 sq.ft. area or more.

In a study of PM2.5 wildfire particles in a small home office, the device delivering 80-90 CFM reduced particles from 160 mg per cubic meter to 10 mg per cubic meter over just a few tens of minutes.

For a Corsi-Rosenthal Box, putting the fan on top reduces the risk of pushing particles into the breathing zone. Upward exhaust makes use of the volume of the space. Air blown upward will eventually come down in an adjacent space and when it does come in contact with virus emitter the air helps breakup the aerosol plume. Because a round fan is fitted into a square housing, fluid mechanical phenomena occurs which causes some of the airflow to move in an opposing direction. Building a circular shroud the size of the fan blades can help reduce this effect.

Pandemic Takeaways:

- Research to Practice and Back Again
- Be Prepared
- Informed leadership helps
- Do not rule out worst-case scenario at the onset.
- Science and engineering provided the tools. (masks, filters, vaccines, etc.)
- Improved science communication is critical.
- It's humans that change things that affect human exposure. Next time, we must include experts in human behavior.
- Diverse rapid response teams with experts in human behavior are needed.
- COVID was a human behavior failure.
- The CDC is great at diseases, the CDC is not good at building science or aerosol science. CDC's resistance to aerosol transmission was frustrating. We need to mend, heal and learn from it.
- COVID has raised awareness about: filtration, HEPA air cleaners, air changes, and created new and increased research interest.

Research to practice and back again.

Z-Man signing off

Trivia:
Name the most in demand course at UC Davis, taught in the chemical engineering department and attracting 2,000 students per year?

Answer: The Design of Coffee, answered by Doug Kohnen, ERAtech Environmental, Dayton, Ohio