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Lisa Brosseau, ScD, CIH

Masking and Respirators; lessons from COVID 19

This week we welcomed back Dr. Lisa Brosseau for a discussion on respirators and masking. After two years of research and real-world experience what have we learned? Dr. Brosseau, now retired, was a professor at the University of Illinois at Chicago (UIC) School of Public Health from 2015 to 2018, where she was director of the Illinois Education and Research Center, which supported graduate and continuing education for occupational health and safety professionals and community outreach activities. She was also director of the UIC Center for Healthy Work.

Dr. Brosseau began her career as an academic researcher and educator at the University of Minnesota School of Public Health, where she directed the Industrial Hygiene Program. Her early research focused on the performance of respirator filters when exposed to hazardous aerosols such as silica and asbestos, and later expanded to include biological and infectious organisms. Her more recent research focused on respirator fit, using real-time methods and simulated workplace tasks to better understand how fit is influenced by realistic head and body motions. She continues to serve as a mentor and technical advisor on research projects and for businesses and organizations, including The Center for Infectious Disease Research and Policy (CIDRAP). CIDRAP is a center within the University of Minnesota that focuses on addressing public health preparedness and emerging infectious disease response.

Dr. Brosseau has authored more than 100 peer-reviewed publications and book chapters, delivered numerous platform research presentations, and has been an invited speaker at numerous local, national and international conferences and workshops. She has written several articles for CIDRAP focused on respiratory protection for healthcare and other workers during outbreaks and pandemics.

### *History of respiratory protection research –*

While respiratory protection can be traced back to ancient Romans. Respirator research has been going on since the early 1900s, motivated in particular by wartime gas, mining and heavy industry exposures. Filtering Facepiece Respirators first became available in the 1980s with the development of non-woven electret materials. The Bureau of Mines managed respirator approval until NIOSH took it over. Surgical masks are not respirators. Surgical masks are not designed to protect against chemical exposures. While it's been demonstrated that surgical masks are not great for infection control and do not protect against inhalation of pathogenic aerosols, they are a healthcare sacred cow.

*NIOSH what type of research have they focused on the past 20 years or so?* -NIOSH approves respirators and conducts research on respirator performance and deployment. They've been doing a lot of research in the past 20 years on respirator use in healthcare - most recently on elastomeric respirators.

*N, R, P 95 99, 100. Why do some types of filter media get an N while others are R or P?*

#### N, R, P Designations Use

When **N** No oil is present in the air.

**R** Oil is present, but only for a single shift or 8 hours of continuous or intermittent use.

Note: Re-use beyond a single shift or 8 hours is not recommended.

**P** Oil is present, but follow the manufacturer's time use limitations if you want to re-use these.

#### 100, 99, and 95 Efficiency Ratings

If the efficiency level is:

This means **100** The filter is expected to trap 99.97 particles out of every 100. It is as efficient as a High Efficiency Particulate Air (HEPA) filter.

**99** The filter is expected to trap 99 particles out of every 100.

**95** The filter will trap 95 particles out of every 100.

*Why is there so much emphasis on N95s and not N99 or P100?* N95 respirators are over engineered, they are designed to perform against the most penetrating particle size at 85 liters per minute (high physical exertion) while most people breathe at 10-30 liters per minute. For exposure to very toxic materials 99 and 100

filters are preferred. Certification is a key requirement. NIOSH has a website to confirm certification. Fake certified masks from China are a problem.

***What is a KN mask?*** KN masks are made in China and approved by Chinese regulators. The Chinese tests are similar to those used to test respirator filters in the US. KN masks are ear-looped not strapped and are more comfortable to wear. KN masks are harder to get good face seals.

***How much do factors such as fit, sweating, heavy work, beards etc. affect mask or respirator effectiveness?***- A  $\frac{1}{2}$  facepiece respirator has a protection factor of 10, which means the air inside the respirator is 10 times cleaner than the air in the environment. Beards and facial hair impact fit. The effect of beards or facial hair on fit is not predictable, so clean shaven is required for workers. Some respirators can injure facial skin if they are worn for many hours or tightly against the face. Respirators come in many shapes: “duck bill”, “boat-shaped, etc.”

***How does working in a respirator all day affect the health of workers?*** Respirators with higher volume capacity are preferred and are more comfortable. Respirators with exhalation valves are much more comfortable, but masks or respirators with exhalation valves were banned during the pandemic because they are thought to emit particles through the valve. Getting used to wearing masks takes time. Some people who are claustrophobic may find wearing a respirator to be difficult. Non-fitted respirators have been demonstrated to provide superior protection over cloth or surgical masks. It's harder to communicate when wearing some respirators or masks.

***Exposures to Covid differ.*** Those infected exhale smaller particles (< 5-10 micron) when breathing and talking and larger particles (up to 100 micron) when coughing and sneezing. The CDC didn't reflect infection pathway accurately. Cloth masks are not designed to be breathed through over time. Cloth masks create resistance which impedes breathing. Cloth masks leak air in both directions. Early messaging about wearing masks to protect people around us resulted in blaming others around us for failure to wear masks to protect us. In retrospect the CDC should have suggested we wear something better that both protects us and the people around us, which would have reduced animosity.

***What can masks do...the science behind COVID 19 protection?*** CIDRAP- Covid 19 Respiratory Commentary Part # 2 reviewed studies and found that hyped mask studies (Bangladesh Study, etc.) don't actually support wearing masks. Problems with the studies are understandable. Masks weren't the only interventions. People who wore masks are likely to have been careful in other ways e.g. isolation and limited interaction were also factors. People's exposures are unknown. No effort to evaluate equivalence in exposure between mask-wearing and control groups. Outcome measures (such as seropositivity) were not accurately assessed at baseline. Could not find a study that demonstrated mask efficacy. Many studies were hyped before publication. Pre-prints needed to be more careful and accurate. One study claimed to have studied One Million Children. A guest essay by the researchers. Adults are at greater risks than students. It's hard to do good masking studies during a pandemic because you need to know the exposures. Dr. Brosseau suggests a workplace study method to better understand exposures using a large department store, for example. One store where employees wore masks and another where they didn't.

Dr. Brosseau added an additional column to a table showing the time to infectious dose for a non-infected person, which illustrated the impact of wearing a Non-Tested & Fit Tested Respirator. The data have demonstrated that 20%-30% of infections occurred within households, but CDC didn't focus on the importance of wearing masks at home to prevent transmission.

The CDC assumes someone can get infected if unprotected and in the presence of an infected person for a total of 15 minutes over a 24 hour period. She divided amount by leakage factor of mask in minutes versus hours.

Respirator manufacturers can be certified for use by consumers during public health emergencies if they follow FDA guidance. Dr. Brosseau did a study in which untrained subjects were given respirators and manufacturers' instructions. While the group did not all attain the same degree of protection as they would if they had been trained to correctly wear the respirator, most participants achieved superior protection over cloth masks or surgical masks. Reasons for this are that respirators have very efficient filters and are inherently designed to fit better.

### Things learned from Covid:

- More respirator innovation in the last 2 years than in the prior 20. (more comfort, better communication)
- Mission of helping small businesses develop and improve designs.
- Continue NIOSH contest and award larger cash prizes.
- Industrial hygienists need to think about infectious disease.
- Recognition that workers are both the source of infection and need to be protected from infection.
- ASTM has developed a new standard. Push for a new public standard.
- Development of simpler fit testing methods for consumers.
- Respirator-like masks for the public are around the corner.

### Dr. Brosseau's Recommended Resources:

- <https://www.cidrap.umn.edu/news-perspective/2021/10/commentary-what-can-masks-do-part-1-science-behind-covid-19-protection>
- <https://www.cidrap.umn.edu/news-perspective/2021/10/commentary-what-can-masks-do-part-2-what-makes-good-mask-study-and-why-most>
- [Reusable Elastomeric Respirators and Health Care Surges ...](#)

Stella Hines, MD, MSPH, is assistant professor at the University of Maryland School of Medicine in Baltimore. The National Academies of Sciences, Engineering and Medicine recommends that reusable elastomeric respirators be considered for routine and surge use in health care respiratory protection programs (RPPs), provided cleaning and disinfection protocols are specified.

### *Z-Man Signing Off*

#### Trivia:

Intended to minimize worker exposures to hazardous chemicals and other risk factors in the workplace an international example of this concept in use is the procedure for the transportation of dangerous chemicals whereby chemicals are classified with United Nations (UN) codes that are used for identifying safe storage rules, permitted types of transport container, and actions to take in an emergency?

**Answer:** Control Banding, answered by Don Weekes