



COVID-19 & Beyond:
Well Living Lab Safe Indoor Environment Program
**STUDY OVERVIEW: PORTABLE AIR FILTRATION
IN A SKILLED NURSING FACILITY**

UNANSWERED QUESTION EXPLORED

How do portable air purification units impact the transmission of potentially infectious airborne particles and overall air quality in a Skilled Nursing Facility (SNF)?

OBJECTIVE

Examine whether portable air purification can reduce how many particles are present in the air and on surfaces in a SNF, which is critical in limiting respiratory virus transmission and improving health and well-being among older adults.

TIMELINE & LOCATION*

The study was conducted during the third quarter of 2022 at a SNF in Rochester, Minnesota.

WHY IT MATTERS

Improved indoor air quality (IAQ) in skilled nursing facilities can limit virus transmission and benefit other health metrics among older adults, such as cognitive function and sleep.

METHODS

This study was conducted in a SNF by leveraging the Well Living Lab's advanced field study platform. The "infectior" room was 30 square meters; the "susceptible" room was 16 square meters. A breathing simulator, connected to an anatomically correct respiratory manikin, mimicked physiologically correct inhalation and exhalation. The simulator exhales particles in both submicrometer and micrometer-size. (For context, the average diameter of a single human hair is 70 micrometers.) These particles were tagged with two different fluorescent dyes (orange and blue) that allow us to measure the mass of particles that deposit on surfaces throughout the assisted living facility as well as the mass concentration present in the air.

STUDY RESULTS & KEY TAKEAWAYS**

The study showed that portable air filtration units made the air exchange rate 4x more efficient, resulting in up to 7x lower particle concentration in the air and up to 7x less virus accumulation on surfaces.

1. Portable air purification units reduced the risk of airborne transmission of the smallest exhaled particles produced while breathing.

- The majority of particles exhaled while breathing are smaller than one micrometer in diameter (submicrometer-sized particles). Particles exhaled from people with respiratory illnesses, such as COVID-19, RSV, or influenza, are primarily this size and can remain suspended in the air for weeks; thus, reducing these particles is necessary to decrease risk of illness.
- Portable air purification units significantly reduced the peak number of submicrometer-sized particles by 64 percent in the same room as the "infectior" and by up to 90 percent in an adjacent room with a "susceptible" individual.

2. Portable air purification units significantly lowered the risk of contact-related transmission via surfaces contaminated with the smallest exhaled particles.

- The units reduced the number of particles in the air, which can lead to less accumulation of particles on surfaces.
- The units effectively reduced virus accumulation on the sampled surfaces by 44% in the simulated "infectior" room and 86% in the adjacent "susceptible" room

3. Operable windows are not consistently reliable as a singular solution for circulating clean air into a space:

- While all SNFs should have operable windows, this type of ventilation is uncontrolled.
- The number of airborne particles and those that accumulate on surfaces was significantly reduced when windows were open versus closed; however, natural ventilation also transported more respiratory virus surrogate particles from the room of the "infectior" to the room of the "susceptible."
- Inclement weather or episodic events, such as wildfires, limit natural ventilation.
- Open windows can have a negative impact on occupant comfort and energy efficiency.

Results of this study are translatable to similarly sized spaces, such as offices, conference rooms, hotel lobbies, classrooms, small apartments, and the like, making stand-alone/portable air purification units an effective component of an overall strategy to reduce transmission.

We know that viruses can remain viable in the air for hours, increasing the likelihood of infection in a poorly ventilated space where an infectious individual is present. From tuberculosis to the common cold to influenza, nearly all upper respiratory conditions have the same potential for airborne spread as COVID-19, thus making stand-alone/portable air purification technology of continued importance in a post-pandemic world.

*Portable units (which can also be wall mounted) are effective for all ages and types of infrastructure. The study was conducted in a skilled nursing facility that began services in 1972 and demonstrated significant improvements without an infrastructure upgrade.

**Results herein are specific to the portable air purifier unit deployed and this unit's specific performance capabilities (e.g., single-pass efficiency, clean air delivery rate, air cleaning technology). As portable air purifiers vary in their performance, the use of other purifiers might yield different results.

PROJECT LEADERSHIP

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