University of Michigan researchers and engineers have developed a solution that provides negative pressure and PPE all in one. The helmet (called Aerosolve) enables the isolated use of a Heated High Flow Nasal Cannula (HFNC) or nebulized medications, sparing the need for a mechanical ventilator or potentially allowing earlier transition from mechanical ventilation. 

Aerosolve’s compact design effectively creates a personal negative pressure environment wherever the patient is, and it maintains that environment even if the patient requires movement (imaging, testing, bathroom, etc.).

**COMPETITIVE ADVANTAGES**

- Rapid setup and readily scalable
- Allows clinicians to use all the tools in their medical arsenal without fear of contracting the illness themselves
- Spares Personal Protective Equipment (PPE)
- Comfortable for the patient
- Beneficial in isolated environments (ground and air ambulances, cruise ships, aircraft carriers, etc.)
- Value beyond pandemics – useful in other respiratory conditions where risk of infectious transmissibility is high

**PRODUCTION TIMELINE**

The team has filed a provisional patent. Quick FDA approval is anticipated as the HHFNC component is already in the marketplace. The device could conceivably go to market with a delivery of at least 1000 units. Production could ramp up to 100,000 units in the quarters that follow.
“In this unprecedented environment of the pandemic, we believe this device has the potential to allow us to more safely utilize therapies which can help treat respiratory failure. By creating a portable negative pressure environment to limit (or eliminate) any aerosolization of particles, this device has the potential to significantly improve safety when utilizing these treatment modalities.

The Negative Pressure Helmet is designed to enhance PPE and protection for healthcare workers, which will allow the health care teams to employ use of best adjunct treatment for the patients with less worry for exposing our team members.”

Jill R. Cherry-Bukowiec MD, MS, PNS, FACS, FCCM, Director of the Trauma Burn ICU

PRELIMINARY TESTING & PATIENT EXPERIENCE

The team has been working quickly and effectively to develop this innovative solution. It was first tested on healthy fellow clinicians in the Emergency Department, exploring many factors—including comfort, ability to speak, and functionality—after which some modifications were made. Then it made the jump to patient care.

The device was trialed, under supervised protocols, in two COVID-19 patients who were hypoxemic and required HHFNC at 50 L/min. Both tolerated the device extremely well, with one patient also having a nasogastric tube and central venous catheter in his neck. One of the patients was even placed in the prone position (on their stomach to help the lung exchange more oxygen) while wearing the device for more than 3 hours.

Clinical, nursing, and respiratory therapy staff found the device to be extremely easy to place and use, commenting that not only did it not interfere with complex patient care but, just as importantly, gave them a greater level of comfort and safety in dealing with patients using aerosolizing therapies like HHFNC.

“Based on the patient encounter and testing to date, it does what it was designed to do and has been an overwhelming success,” said Dr. Bassin.

“These novel helmets have the potential to decrease the need for mechanical ventilation and improve patient care, while protecting caregivers from the risks and hazards of the infectious droplets and aerosols.”

Milo Engoren, MD, FCCM, Professor, Anesthesiology, Section Chief, Critical Care Medicine

Dr. Kevin Ward tests the negative pressure device. The system draws oxygen, as well as room air, into the helmet, while pulling exhaled air and any other outflow through a high efficiency particulate air (HEPA) filter, clearing it of the virus.

Preliminary data shows airflows through the hood approach 320 liters/minute, which is more than 20 times greater than the air exchanges produced by a negative pressure room.