What’s the Problem?

- The COVID-19 pandemic created a high need for manual ventilation and threatened to overwhelm ventilator capacity.
- Performing continuous ventilation on patients with COVID-19 places the provider at risk due to a fractional failure rate of a single HEPA filter leading to viral aerosolization.
- Methods to further reduce exposure to viral aerosolization are needed for this prolonged procedure.

Approach

- Experts from the Thomas Jefferson University Health Design Lab met with Emergency Medicine and Anesthesia physicians and local engineers.
- A design was envisioned in which 3-D printed connectors could be created to add an additional HEPA Filter as shown in Figure 1.
- STL Files for the adapters were created based on standard HEPA filter diameters and 3-D printed.

- The second HEPA filter was easily assembled by novice users using the adapters.
- Ventilation adequacy using the double HEPA filter ambu-bag was similar to single HEPA filtered ambu-bag ventilation based on observed inflation of a test lung.

The apparatus is easy to assemble and use. The solution is cheap, rapidly deployable and available via open access 3-D print files.

Additional study is needed determine if an added filter leads to significant reduction in COVID-19 transmission from continuous manual ventilation.

Demonstration video: [https://rescueventilation.com/double-hepa-filter](https://rescueventilation.com/double-hepa-filter)

Special acknowledgment to Larry Chu MD, James Barlow, John Spetrino, James DuCanto MD, Aaron Miller, Chris Neely.