# DEVICE ACCELERATOR: HOW A VEST FOR COPD EVOLVED

*Photos by Peggy Peterson*

Through the Penn Medicine Medical Device Accelerator, a physician's back-of-a-napkin sketch may soon offer patients a new aid to breathing.

**V1**
- Prototype
- CD case around commercially available air pump
- Attached with backpack straps

**V2**
- Prototype
- Custom 3-D printed air pump and casing
- Attached to vest with ski boot straps

**V3**
- Preliminary design
- Lighter weight, more powerful 3-D printed pump
- Belt inspired by a spinal brace
- Ready for clinical trials

**V4**
- Streamlined design
- Smallest, lightest, most powerful air pump
- Nearly ready for commercial production

Michal Swoboda, Chief Technology Officer, Right Air, LLC

DEVICE ACCELERATOR:

# RIGHT AIR

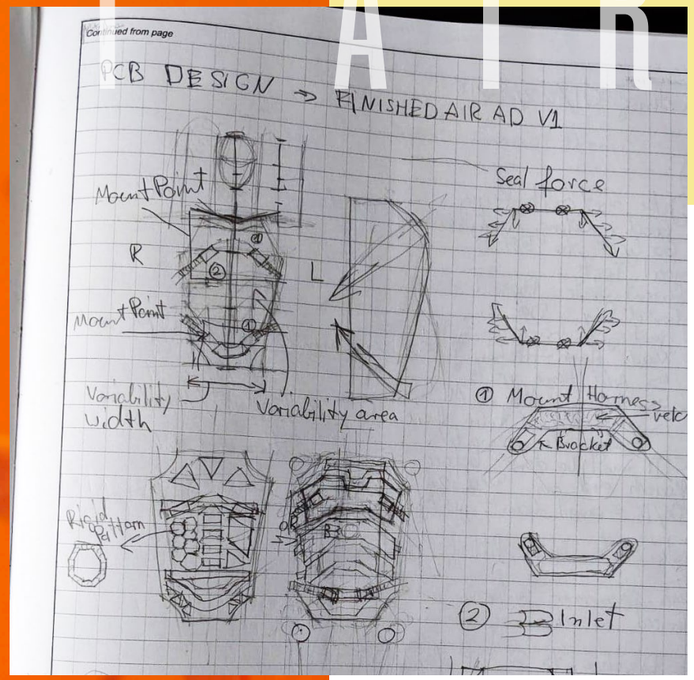
The original idea was an old one. An iron lung is a classic form of mechanical respirator that used both negative and positive air pressure to inflate and deflate the lungs when a person lacked ability to do it for themselves—such as when a patient was paralyzed by polio.

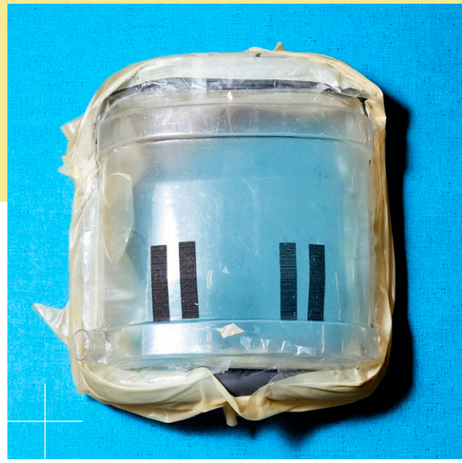
Modern-day patients with COPD, often called emphysema, can breathe on their own, but due to changes in the lungs caused by past smoking, they frequently experience shortness of breath. This symptom is even more pronounced during physical activities as simple as walking from room to room. COPD affects 15 million people in the U.S.

"What if we could make a vest that can decrease the shortness of breath of COPD patients such that they are able to engage in life again?" wondered Jake Brenner, MD, PhD.

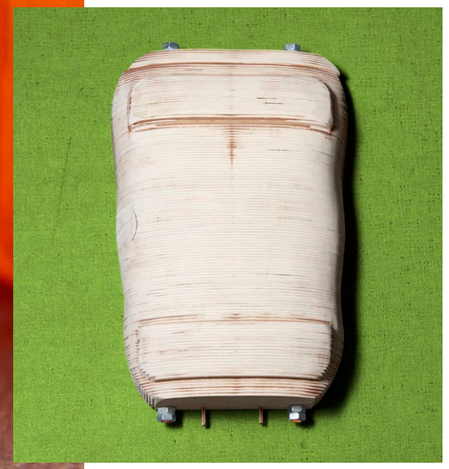
Starting with a series of simple sketches, Brenner, a pulmonary critical care physician, aimed to update the functionality of modern respirators based on the same principle as the iron lung. These devices use a front and back turtle-like shell surrounding the chest with an attached pump to apply pressure. However, such existing devices are impractical for patients, like many with COPD, to use during their daily lives. Brenner's vest would be wearable anywhere.

The idea was accepted into Medical Device Accelerator (MDA) program at Penn Medicine in 2017, which provided Brenner with seed funding and interdisciplinary expertise to move through a streamlined development process. He formed a company, Right Air, LLC, and set up a staff working out of NextFab, a maker space that is a ready-made Santa's Workshop for inventors.



The shell of the first prototype of the Right Air vest mirrored the shape of existing commercial ventilators. Brenner and Swoboda used simple rubber sheeting to produce a seal between the vest and the wearer's body.

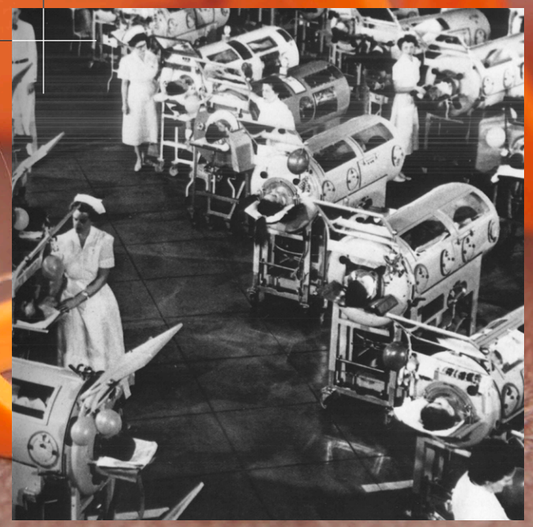


A shape form for molding a version of the plastic vest shell was laser cut in the NextFab woodshop of thin slices of wood.

A pump worn on the back uses air pressure to push and pull on the vest, which is a hard plastic shell on the wearer's chest.

**Negative pressure:** Air passages in the lungs open up to make it easier to inhale.

**Positive pressure:** Compressing the lungs makes it easier to exhale.



Medical Device Accelerator Process

Phase 1: Product definition → Phase 2: Concept development → Phase 3: Product development

Phase 4: Verification & validation → Phase 5: Design transfer → Phase 6: Commercial transfer

"Penn physicians with medical device ideas are first and foremost just that: physicians and researchers. We help them take ideas deeper into the commercialization process to answer more questions about safety and functionality, faster than they could otherwise."

*– Mohit Prajapati, MBA, Director of R&D Strategy and Operations, Medical Device Accelerator Program*

Initial clinical trials for the Right Air vest were completed this year. Under the continued guidance of the MDA, the team is in the process of regulatory evaluation in advance of launching sales of the vest as a commercial product.

Marek Swoboda, PhD, CEO of Right Air, LLC, with founder Jake Brenner, MD, PhD

**Right Air is just one product among many that the MDA is ushering into practice year after year. Read more about a video-guided catheter designed to change minimally invasive brain procedures and gene therapy online at PennMedicine.org/magazine/mda.**