

Design Optimization of Emergency-Use Ventilator to Improve Assembly  
Time  
(Technical Report)

Mitigation of Work-Related Mental Health Stresses Faced by Medical  
Professionals in the United States  
(STS Research Paper)

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## **Preface**

How may healthcare provision be improved?

Ventis Medical's low-cost emergency ventilator, the VM-2000, has 1.8 meters of tubing. Each component must be individually plugged in, and functions only with a button on the device's main body. These design features may prolong device assembly, entangle components, and delay care delivery. To improve the usability and efficiency of the device for medical professionals and their patients, the project team determined a more suitable tubing length, designed a 3D-printed manifold and tubing clamp in Fusion 360, and integrated a wired button to enable more convenient administration of automated ventilation. After multiple prototype iterations, the team achieved an average reduction in ventilator assembly time of  $3.82 \pm 1.92$  seconds and succeeded in improving the device's usability. By improving ease of use for both patients and caregivers, the project may improve the accessibility and versatility of ventilators.

In the United States, mental health conditions such as depression and burnout occur at greater rates among medical professionals than among the general population. The consequences are serious for health professionals and for their patients. To mitigate the work-related mental health stresses to which medical professionals are subject, nonprofits, public agencies, hospitals, clinics, and companies in the healthcare sector have demanded legislative and regulatory reform, spread awareness of the issue, and promoted wellness resources for health professionals. While some professionals report improvements, efforts so far have largely been limited to the problem's effects to the neglect of its underlying causes.