

Thesis Project Portfolio

Non-invasive Ventilation and the VM-2000: Improving the Versatility of an Affordable, Easy-to-Use Emergency Ventilator
(Technical Report)

**Discriminatory Nature of Quality Adjusted Life Years:
Especially during the COVID-19 Pandemic**
(STS Research Paper)

An Undergraduate Thesis

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Table of Contents

Sociotechnical Synthesis

Non-invasive Ventilation and the VM-2000: Improving the Versatility of an Affordable, Easy-to-Use Emergency Ventilator

Discriminatory Nature of Quality Adjusted Life Years Especially during the COVID-19 Pandemic

Prospectus

Sociotechnical Thesis

Introduction

During the COVID-19 pandemic, medical rationing became a subject of much debate. As European countries faced massive shortages in the necessary equipment to treat the disease, Americans feared the same shortages would occur here. In response, policy makers applied Crisis Standards of Care to help governments, communities and hospitals decide how to ration available equipment. Fortunately, the United States never saw the same shortages and hospitalization rates as Europe and many of the standards put in place were never used. However, those standards were blatantly discriminatory toward people with physical disabilities. My STS research focused on finding evidence of this discrimination and my technical project focused on advancing the design of a ventilator to help fill the gap in equipment shortages.

Project Summaries

Using information gathered from the National Council on Disability and several law reviews I found evidence that Crisis Standards of Care and associated metrics deprioritize people with disabilities. They use quality of life metrics to establish how a treatment would improve a patient's life. The metrics are very similar to those used by Quality Adjusted Life Years (QALYs), an economic tool originally developed to set treatment and drug prices. QALYs and the Crisis Standards of Care allowed physicians to deny treatment to people who are physically disabled on the basis that their lives would not be as improved by the treatment as an able-bodied individual.

My technical project helped advance the design of the VM-2000, a small portable ventilator from Ventis Medical. Ventis was started in March 2020 in response to the need for more easily accessible ventilation. My group and I have worked to incorporate a noninvasive ventilation option into the ventilator. The noninvasive function will allow more people to use the

ventilator without extensive training. We have tested the noninvasive algorithm with several different types of masks to determine which mask would be best to attach to the ventilator. We have also tested the noninvasive ventilation function against the invasive ventilation function to ensure that it is still giving suitable ventilation. Data from the project is still being analyzed so I am unable to report the results at this time.

Conclusion

The VM-2000 would have been a vital tool to close the gap between equipment needed and equipment available during the COVID-19 pandemic. However, because policy makers were forced to make plans for medical rationing, the discriminatory nature of the Crisis Standards of Care and QALYs was exposed. These projects opened my eyes to how easy it is to be unintentionally discriminatory. Part of the focus of my technical project has been to choose a mask that would fit the largest number of people possible. Although it can be more difficult to find solutions that fit everybody, both my STS project and my technical project have taught me the danger of discrimination, especially in medicine.

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