

## **Thesis Project Portfolio**

### **A Systems Approach to Optimizing Patient Flow During the COVID-19 Pandemic**

(Technical Report)

### **Analyzing the Effect of COVID-19 on Telemedicine and the Virtual Delivery of Healthcare**

(STS Research Paper)

An Undergraduate Thesis

Presented to the Faculty of the School of Engineering and Applied Science

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## **Sociotechnical Synthesis**

Health systems worldwide have been disrupted significantly as a result of the COVID-19 pandemic. To mitigate the spread of COVID-19, healthcare systems – including the University of Virginia Health System – reduced ambulatory visits and implemented various social distancing measures, resulting in a drastic change in the appointment process that has reduced the efficiency of patient flow. The focus of the technical work is to accurately characterize the effect of COVID-19 on one of the UVA Primary Care clinics, and where possible, to refine and optimize patient flow through the appointment process while accommodating public health restrictions. To achieve these goals, the team adopted a systems approach, which involves the iterative process of problem identification, analysis, and testing recommendations. Through extensive data collection and analysis, the capstone team was able to understand the pandemic's impact on the clinic's patient flow and identify key problem areas at each stage in the appointment process. The team then used these insights to develop informed recommendations and test them. Through a pilot of a new remote registration process, on-time patients increased from 68% to 75%, the perceived workload of nurses decreased significantly, and the arrival process became more predictable. From this work, the team was able to develop a more generic framework for how health systems might assess and address patient flow issues under normal circumstances as well as during future pandemics.

Although it was not the primary focus of the technical project, one of the key ways in which the Primary Care clinic, UVA Health, and health systems across the United States in general responded to the onset of the pandemic was through the rapid adoption of telehealth technologies to deliver care virtually at a distance. Thanks to said rapid adoption, the healthcare industry is in the midst of a virtual revolution, and the potential for healthcare delivery to shift

into a virtual space looms larger than ever before. The STS research paper leverages Thomas Kuhn's theory of paradigm shift to analyze the uptake of telehealth according to and in terms of the phases of the Kuhn Cycle. The cycle depicts how a new scientific model deviates from, challenges, and eventually replaces a reigning model, and it is crucial to understanding the development of virtual medicine and the future of care. After discussing the origins of remote care relative to the traditional model of in-person care, the paper focuses on the crisis presented by the COVID-19 pandemic and on how it has necessitated the adoption of telemedicine and has revealed the potential for virtual medicine. The research then concludes with a discussion of the potential for virtual care to become part of the reigning paradigm and of what such a shift could mean for healthcare in the future.

Both the technical report and the research paper seek to address changes to the healthcare industry brought about by the COVID-19 pandemic. While the technical project focuses on patient flow refinement and optimization, the research paper focuses on the emergence of telemedicine and its place in healthcare delivery. Together, these papers represent the effect of the pandemic on the healthcare industry and provide insight into the future of medicine.