COVID-19 Lexington Report

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Abstract

Our COVID-19 model represents the coronavirus situation in Lexington, Virginia. Key features of our model involve multiple stages of virus transmission during pre-federal lockdown, federal lockdown, post federal lockdown, and the start of Washington and Lee's fall semester.

1 Introduction

The coronavirus has become the dominant focus of 2020 by dramatically changing nearly every aspect of everyday life. The spread and fear of coronavirus has already affected colleges and universities across the country by forcing classes to be held online during the last portion of the 2019-2020 academic year. However, it is probable some of the effects of coronavirus on education, and more specifically higher education, are still to be seen. Schools across the country are faced with difficult decisions as they choose between quality of education and the safety of students and local populations. This model simulates coronavirus on the campus of Washington and Lee University in Lexington, Virginia. It examines the spread of virus from the first confirmed case to the fall semester when students will return for classes.

2 Motivation

We may never get another opportunity to research something quite like our present-day epidemic. Due to the nature of COVID-19 and the uncertainty of virus's spread over time, it's necessary to construct a model that will accurately predict the number of cases at a given location over a certain period of time. Without such a model, it is much more difficult to know to what extent a town or state needs to impose a lockdown. There are consequences for locking down too long or opening up too early. We want to find a middle ground where the city of Lexington and Washington and Lee University can operate normally with appropriate social distancing policies without overwhelming the healthcare system. Because Lexington is a rural city, low population density becomes an important factor in determining the transmission rate. Less people means it will be easier to track the spread and provide the necessary precautions to treat and isolate the infected while keeping others safe. The caveat here is that Lexington does not have the hospital resources that a major city has. Lexington has a smaller capacity for COVID-19 testing and treatment. If we were to encounter a scenario where coronavirus spreads rapidly among high-risk residents, we could be in danger of maximizing our healthcare capacity, and in the worst-case, not be able to provide hospital care for everyone who needs it.

An accurate model of virus transmission will allow policy makers to have a clearer picture of what restrictions should be put in place. Since the coronavirus has implications on college campuses, businesses, and travel restrictions, a model can give us an indication on how to conduct our daily work lives in a smart and responsible way. A school that can work

within its own system to minimize interpersonal interaction and attempt to limit travel will be in a much better position to successfully fend off the spread of coronavirus. While we cannot account for all the externalities present in our scenario, we believe this simulation provides an accurate representation of who is at risk, how quickly the virus can spread, and how to mitigate the virus.

3 Methodology

We use an SEIR epidemiological model as the foundation of our project. SEIR stands for susceptible, exposed, infected, and recovered. These variables will signify who is at risk, who has been exposed to the virus, who is currently sick, and who has returned to full health from the virus. In this model, we've drawn out these variables to include multiple instances of being susceptible, exposed, infected, or recovered. In other words, this could mean that someone is exposed

We have two important populations we want to focus on. First, we look at the current population of Lexington residents, and then look at the scenario of Washington and Lee undergraduates returning for the fall semester. Washington and Lee has several unique factors that set apart campus life from other schools; these could change how coronavirus should be modeled. Washington and Lee has smaller class sizes, fewer enrolled students, and only about 7,000 people in the town of Lexington itself.

Our model is very behavioral-based in that how people quarantine or infect themselves is determined by individual choices.

4 Results

The purpose of our model was to represent a system in Lexington, Virginia where the virus has a potential to infect others.

It is important that the model works correctly and that it satisfies the

5 Conclusions

As with any model, it is important to revisit its structure and make any necessary adjustments over time. Because Lexington has a small population, its changes will likely be less dynamic over time than say, a large metropolitan area. However, it is still important to track any new developments. If and any new developments occur over the next few months, we should return to our model and add or modify variables that offer a better projection of virus transmission. For example, if new state policy is enacted or an unseen source of the virus is discovered, we can adjust our variables to account for that. We can also return to our model to see if our simulation has matched the real-time process of COVID-19. If our model is able to simulate this virus accurately, we can look back with confidence that our model informed us of the virus's effect on the community, and that we prepared accordingly.