

Improved Healthcare Decision-making through Data and Advanced Mathematical Modeling

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The COVID-19 pandemic has given rise to many complications in medical decision making. In early January 2021 we witnessed paramedics in Southern California being advised to not transport patients to hospitals who have little chance of survival. Although this decision is hard to administer, Los Angeles County felt it best to conserve available resources for those they deemed more fit for survival. Considering the limitation in available resources in hospitals as the number of critical care cases increases, decisions must also be made regarding how the resources are allocated among patients. Different hospitals and health care systems have variations of protocol when it comes to critical care patients. According to *The Society of Critical Care Medicine*, current protocol dictates that critical care resources be primarily for patients who need them but who are not too sick [1]. These protocols could potentially have a greater effect on some racial groups than others.

Compared to White persons, the COVID-19 mortality rate for minority groups (i.e., Black, Latino, and Native American) are at least two times higher [2]. There are various factors at play into how people of a minority group are considered more at risk of infection, hospitalizations, and ultimately death. Some of which include underlying health conditions highly prevalent in different communities of colors, that when combined with COVID-19 can have detrimental effects. Other factors involve social determinants of health that impact interactions with the health care system such as access to care, systemic racism and bias, and lack of quality care. Given the differences in mortality and hospitalization rates, there is evidence to suggest that COVID-19 progresses differently for different racial groups. The purpose of this project is to provide solutions to the decision of the optimal policy for allocating critical care resources within a health care system to minimize the number of deaths and explore strategies for decreasing the mortality gap.

COVID-19 positive patients can be characterized into 3 health categories: i) too well for critical care, ii) can benefit from critical care, and iii) too sick for critical care. Patients who are too well for critical care have a low anticipated mortality and high likelihood of recovery. These patients are recommended for watchful waiting. Patients who are too sick for critical care are not expected to survive even with maximum therapy. They are not offered access to critical care and instead receive palliative care and non-critical care medical management. Patients who would benefit from critical care are critically ill with reasonable expectation of survival and thus receive critical care, if available. If critical care is not available, they are placed on a wait list and selected for treatment through a lottery system [1]. We model patient treatment paths to evaluate if decisions in critical care protocols lead to increased mortality for minority groups through the modeling of disease progression as a function of various demographic factors such as gender, race/ethnicity, age, and BMI.

References

- [1] K. Fischkoff *et al.*, "COVID-19 Resources COVID-19 Resources," 2020.
- [2] C. Laboratories and N. S. Surveillance, "Outpatient and Emergency Department Visits Severe Disease," vol. 28, no. Ili, pp. 1–14, 2020.