IBM Final Project Capstone

Covid-19 and the health care system of New York, US

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1. Introduction

In the last few days we have been experiencing a major health crisis due to the novel coronavirus pandemic, and the main risks of the pandemic is not only the virus itself, but the collapse of the health system. Therefore, this work aims to analyze the distribution of hospitals and ICU beds together with data about the contamination of corona virus.

2. Data source

- **Covid-19 cases in the United States:** States Current Values of infected is obtained from COVID-19 Tracking project. The COVID Tracking Project collects information from 50 US states https://covidtracking.com/api/

- **ICU beds in United States:** Kaiser Health News evaluated the capacity of intensive care unit (ICU) beds around the nation by first identifying the number of ICU beds each hospital reported in its most recent financial cost report, filed annually to the Centers for Medicare & Medicaid Services. https://khn.org/news/as-coronavirus-spreads-widely-millions-of-older-americans-live-in-counties-with-no-icu-beds/

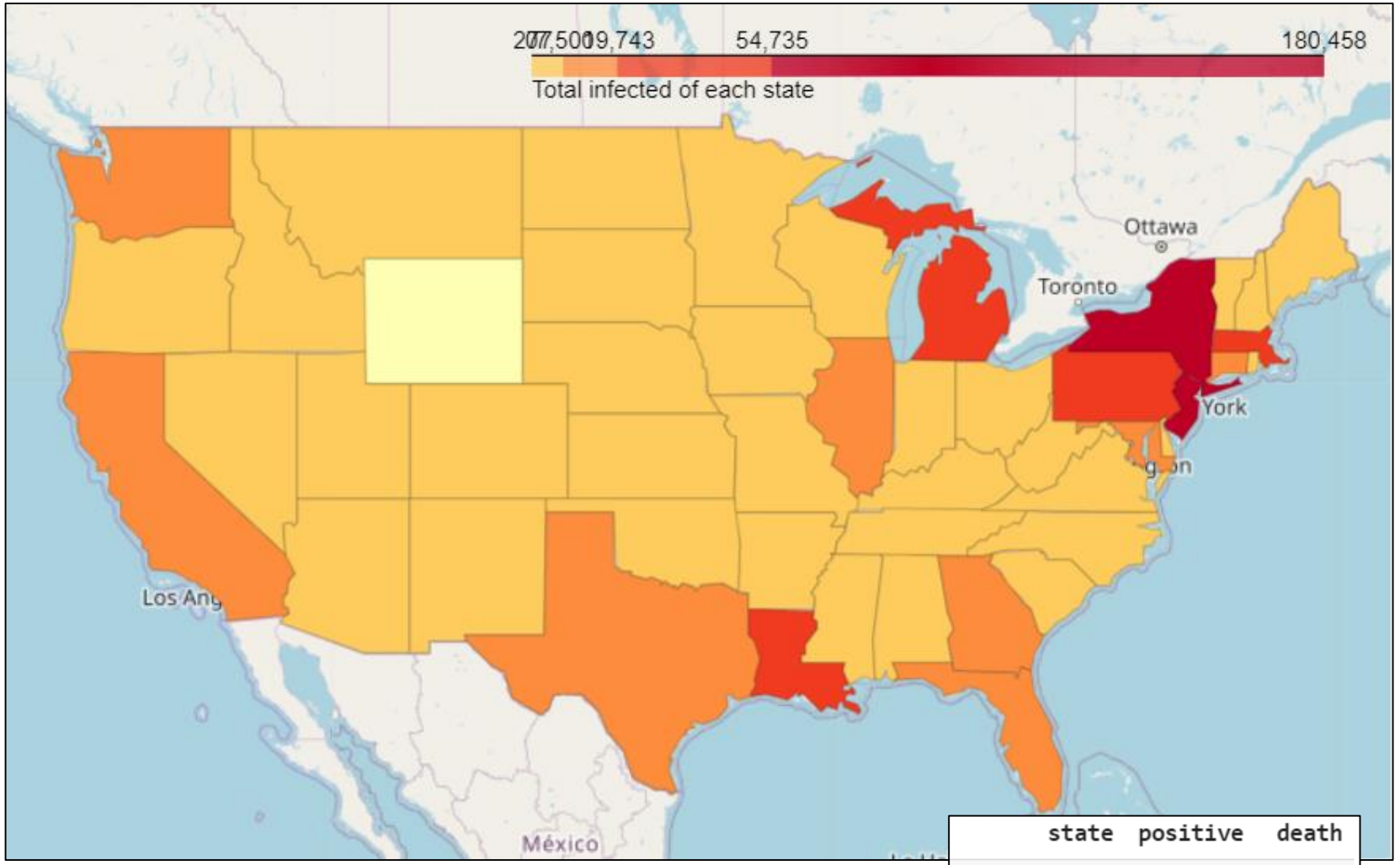
- **United States hospitals:** This database contains locations of Hospitals for 50 states and Washington D.C., Puerto Rico and US territories https://catalog.data.gov/dataset/hospitals-dcdfc

- **New York COVID-19 data:** For the neighborhood in New York City was used the dataframe by New York City Department of Health and Mental Hygiene. In:https://www.nytimes.com/interactive/2020/04/01/nyregion/nyc-coronavirus-cases-map.html

3. Background of the problem

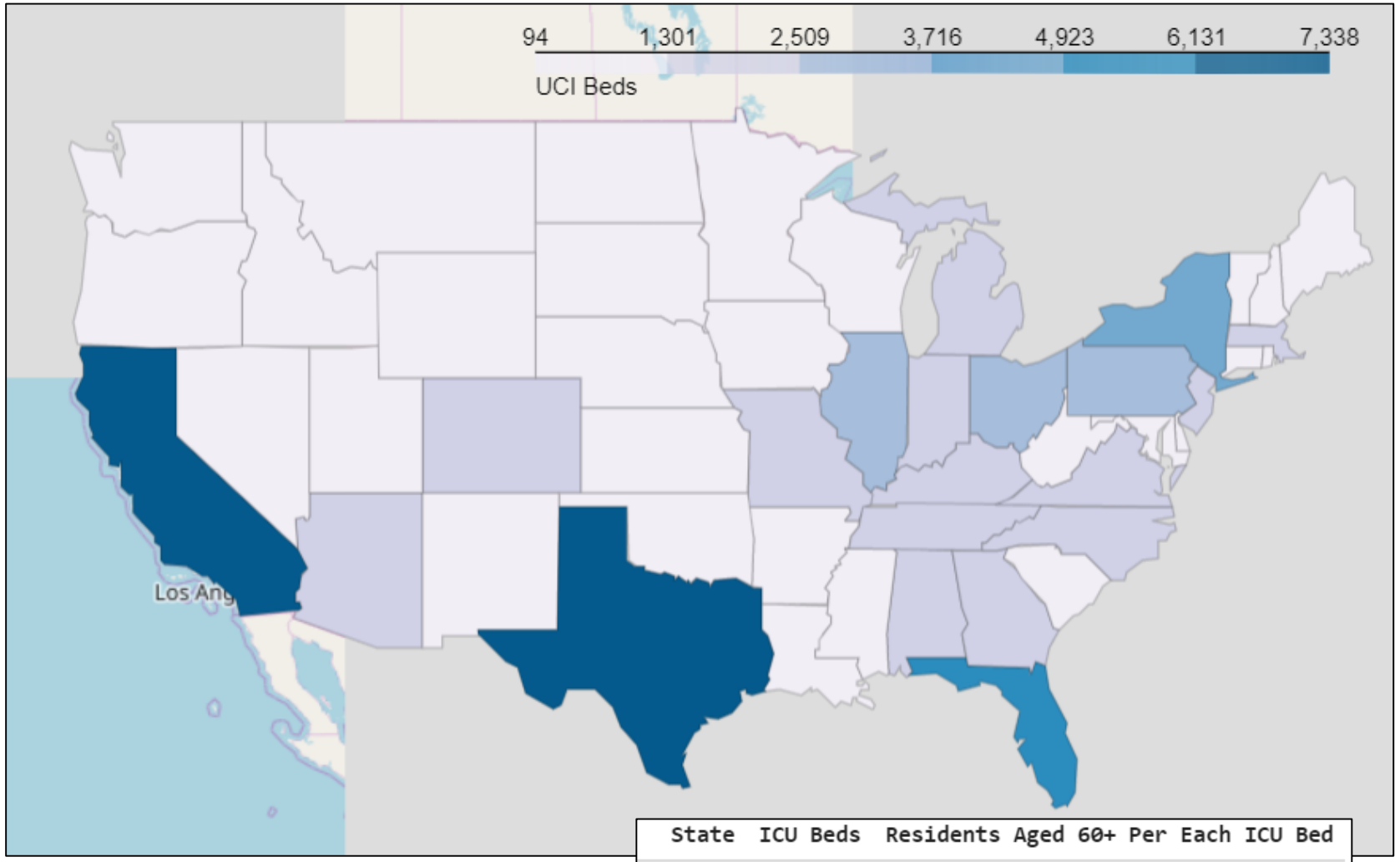
- Numbers of infected each state
- Numbers of ICU beds each State
- Numbers of hospitals beds each State
- Balance between hospitalized people and ICU and Hospital beds
- Relationship between the limit of ICU beds and the fatality rate

Numbers of infected each state



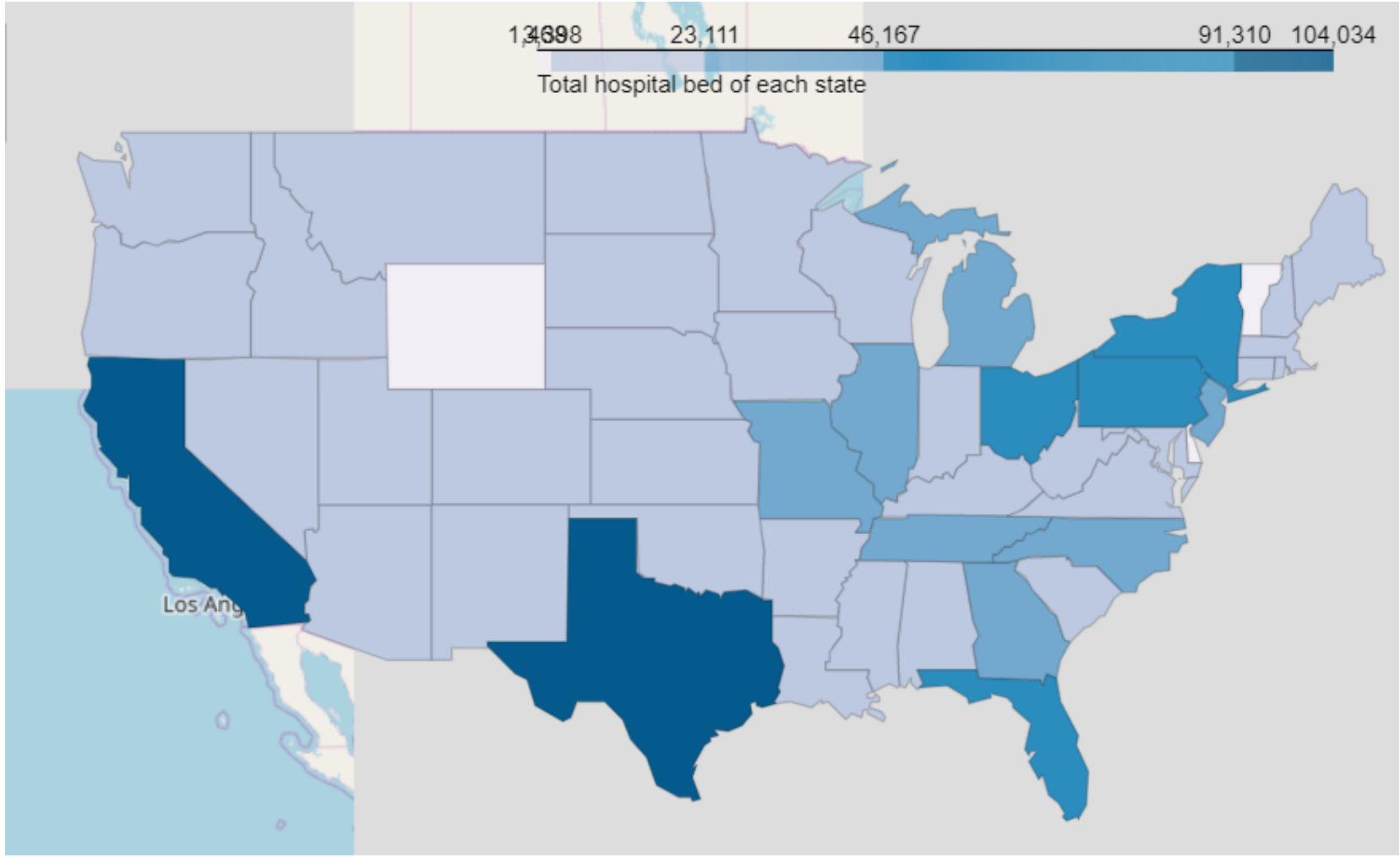
state	positive	death
New York	188694.0	9385.0
New Jersey	61850.0	2350.0
Massachusetts	25475.0	756.0
Michigan	24638.0	1487.0
Pennsylvania	22833.0	507.0

Numbers of ICU beds each State



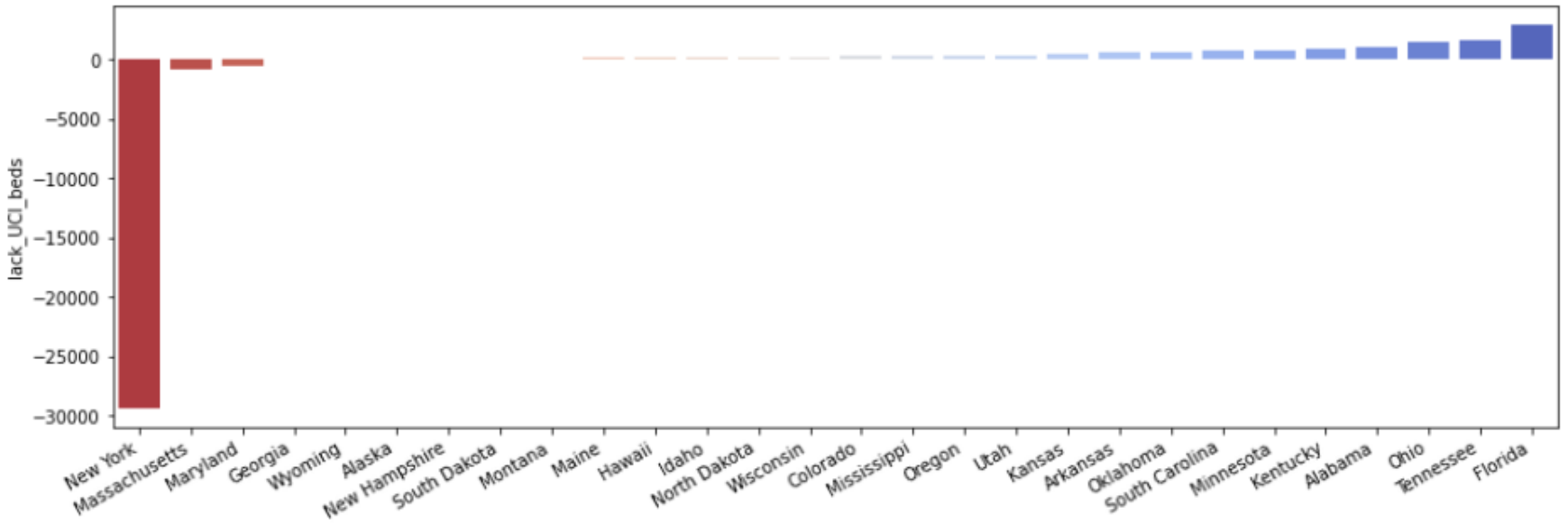
State	ICU Beds	Residents Aged 60+ Per Each ICU Bed
California	7338	68758.0
Texas	6199	99694.0
Florida	5604	52222.0
New York	3952	72521.0
Ohio	3314	97902.0

Numbers of hospitals beds each State

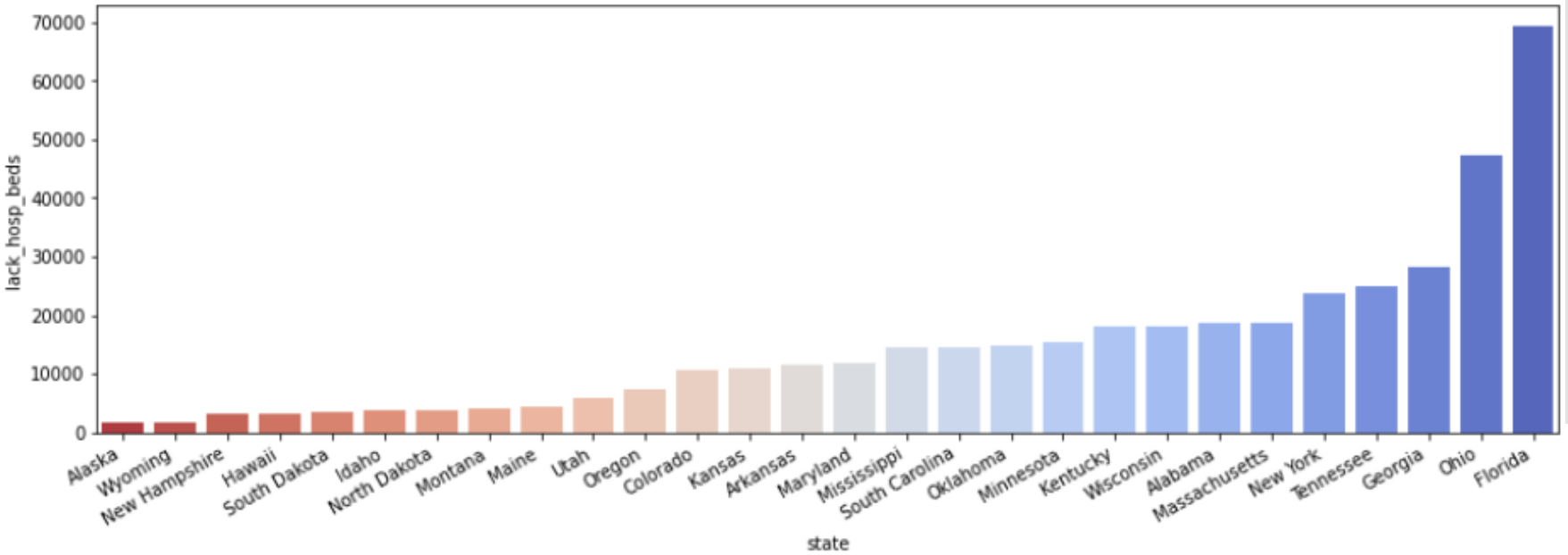


Balance between hospitalized people and ICU and Hospital beds

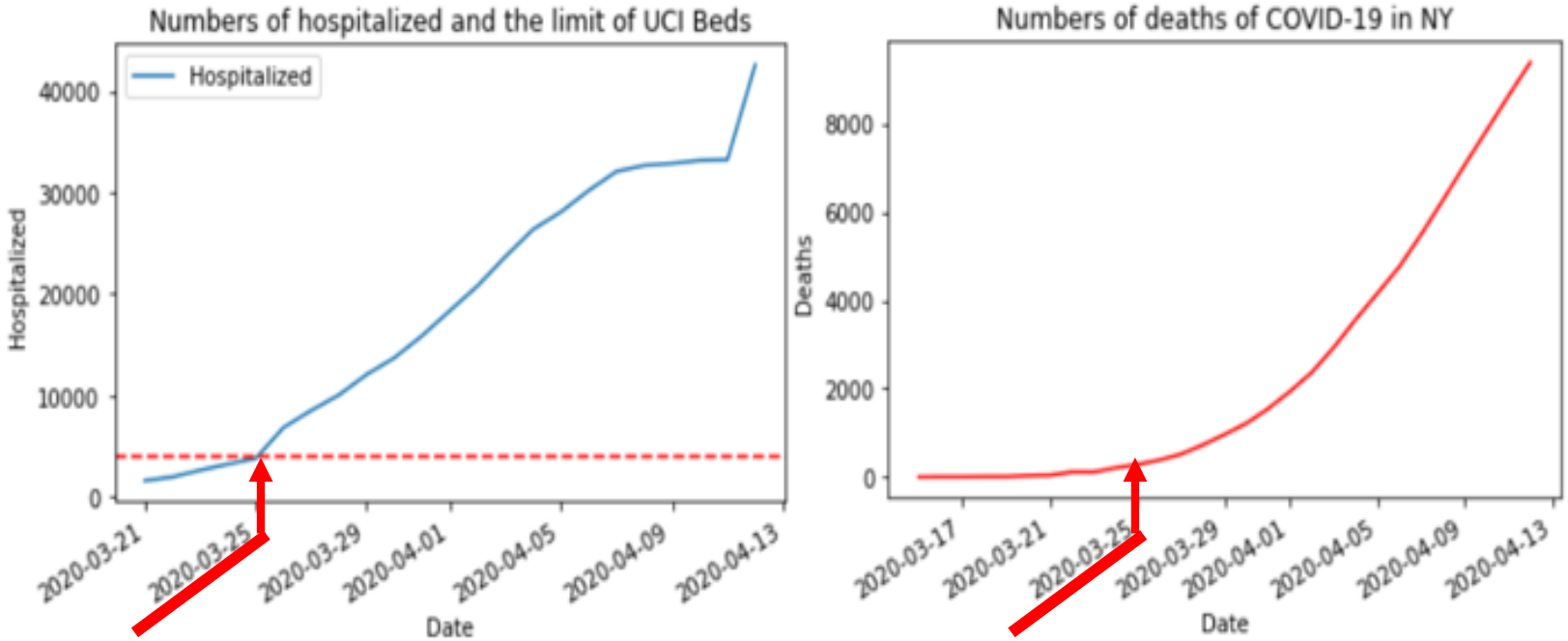
Graphs with the balance between hospital people and UCI beds in each state



Graphs with the balance between hospital people and hospital beds in each state.



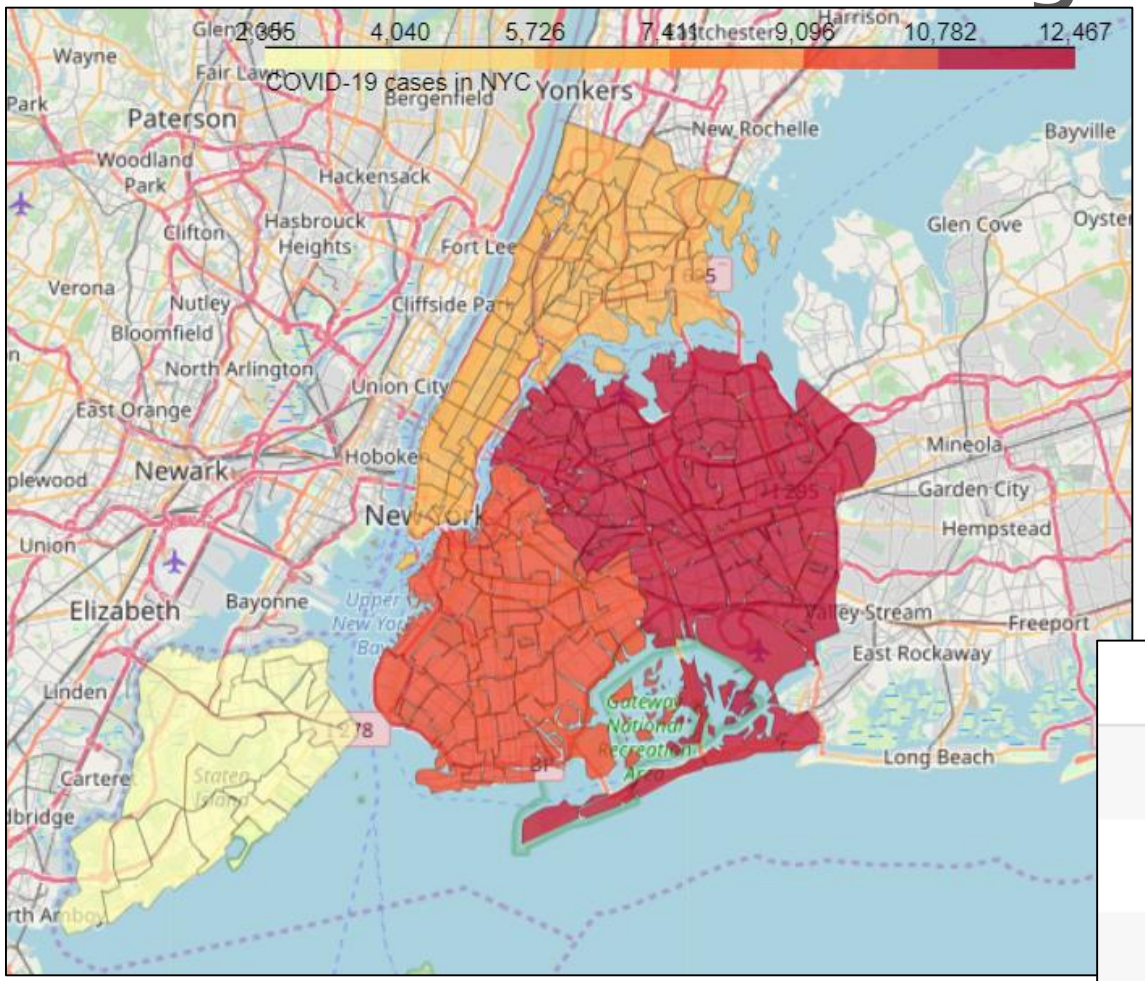
Relationship between the limit of ICU beds and the fatality rate



From the day that the numbers of hospitalized people pass the ICU bed limit (2020-03-25), the fatality rate increases considerably.

4. New York healthy system and COVID-19

- Infected and the boroughs



Borough	Total cases
Queens	12467
Brooklyn	10735
Bronx	7183
Manhattan	6106
Staten Island	2355

Choropleth map of the NYC with the total ICU beds of each infected each borough

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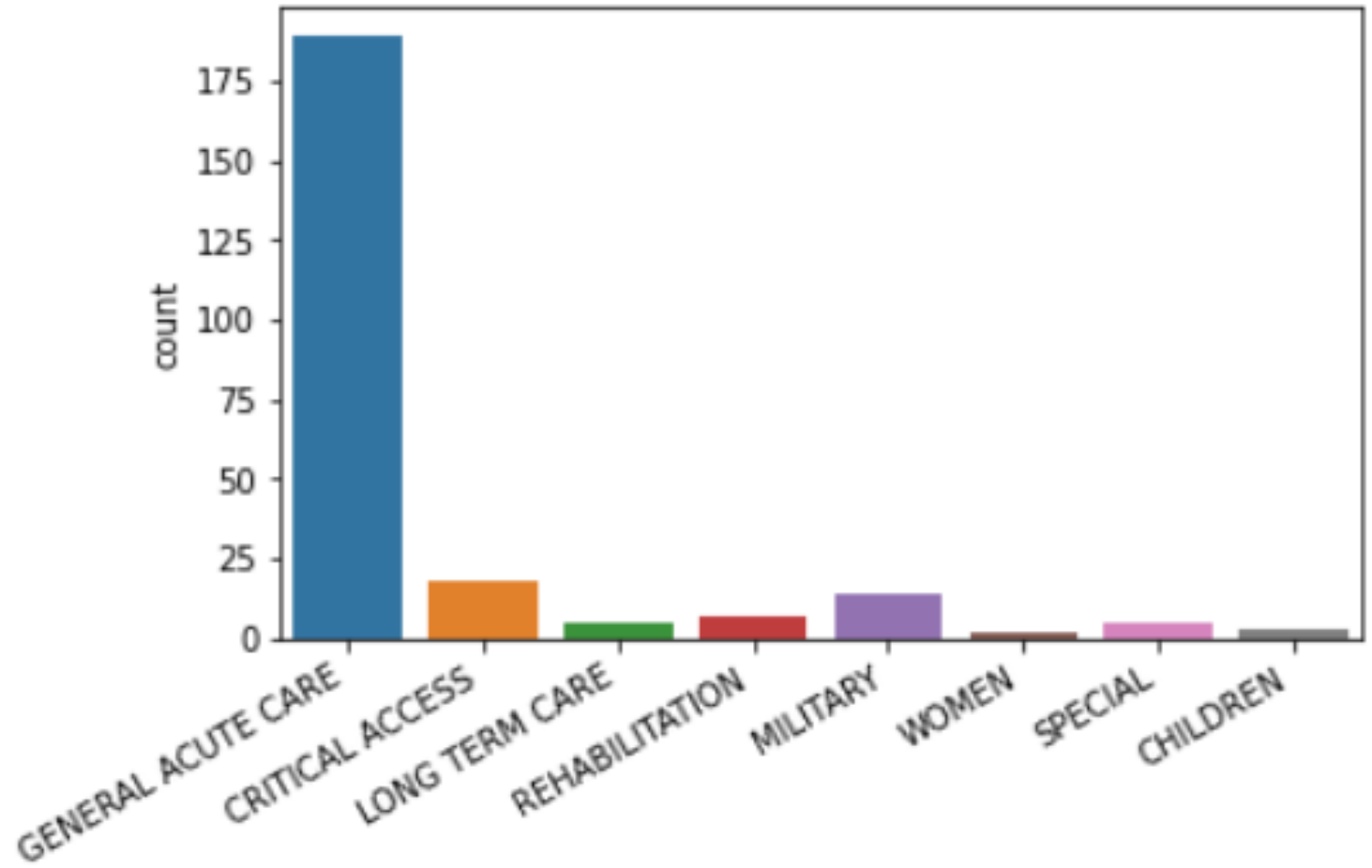
Density of infected people in map of the NYC

4. New York healthy system and COVID-19

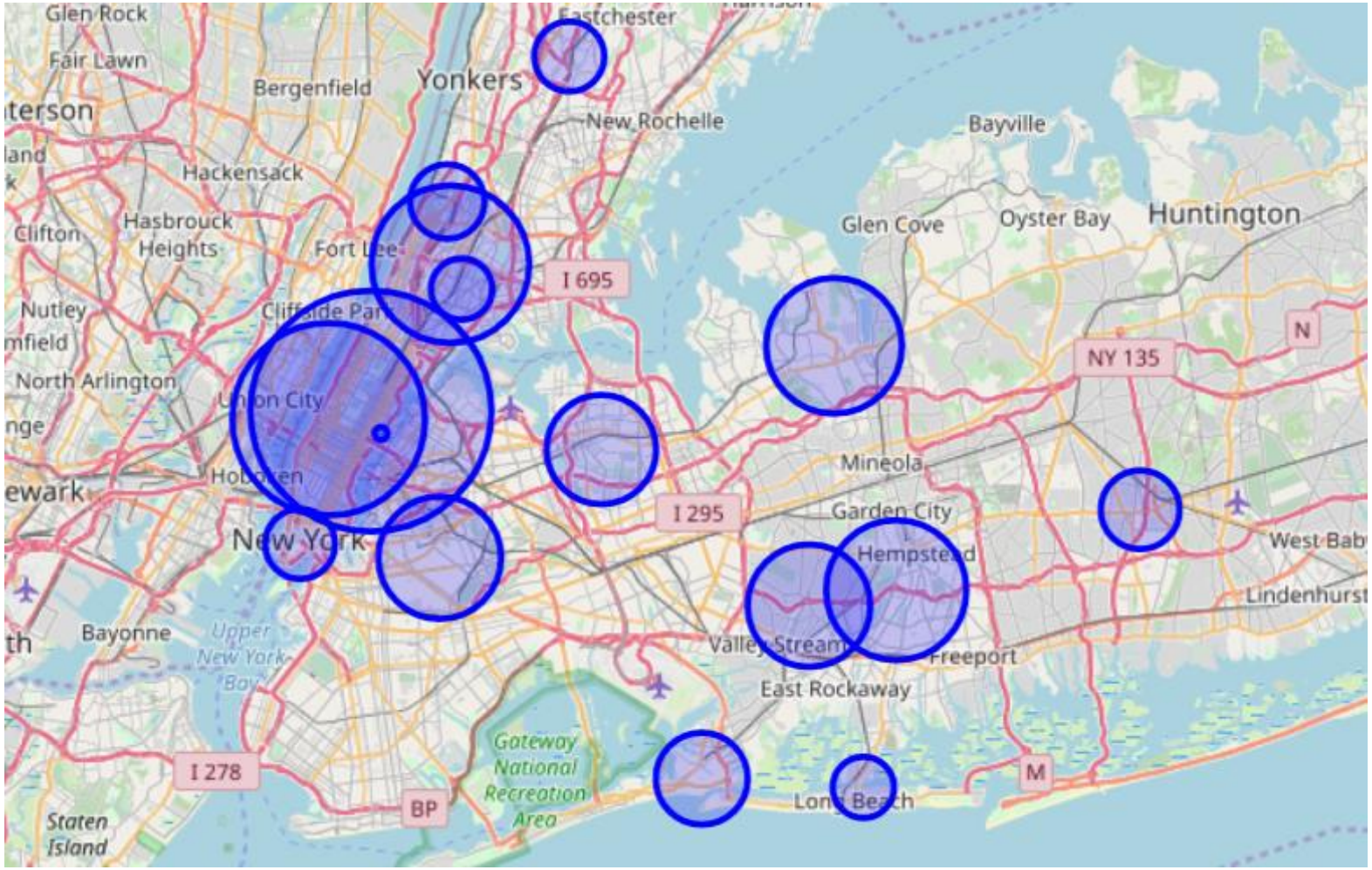
- Hospitals and bed distribution in NYC



Numbers of each type of hospital in NYC.

4. New York healthy system and COVID-19

- Hospitals and bed distribution in NYC



Bubble map with the proportion and distribution of hospital bed in NYC.

4. New York healthy system and COVID-19

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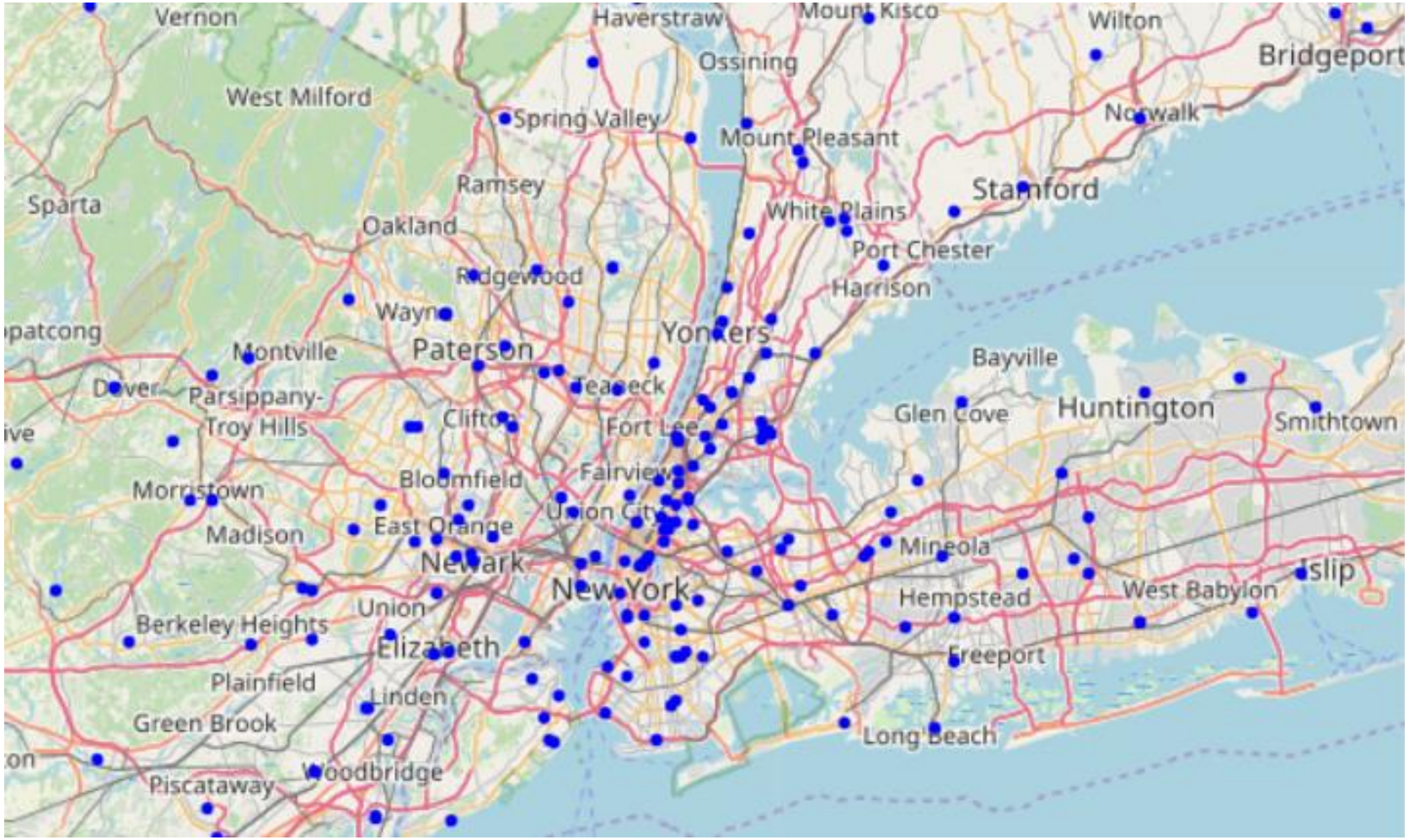
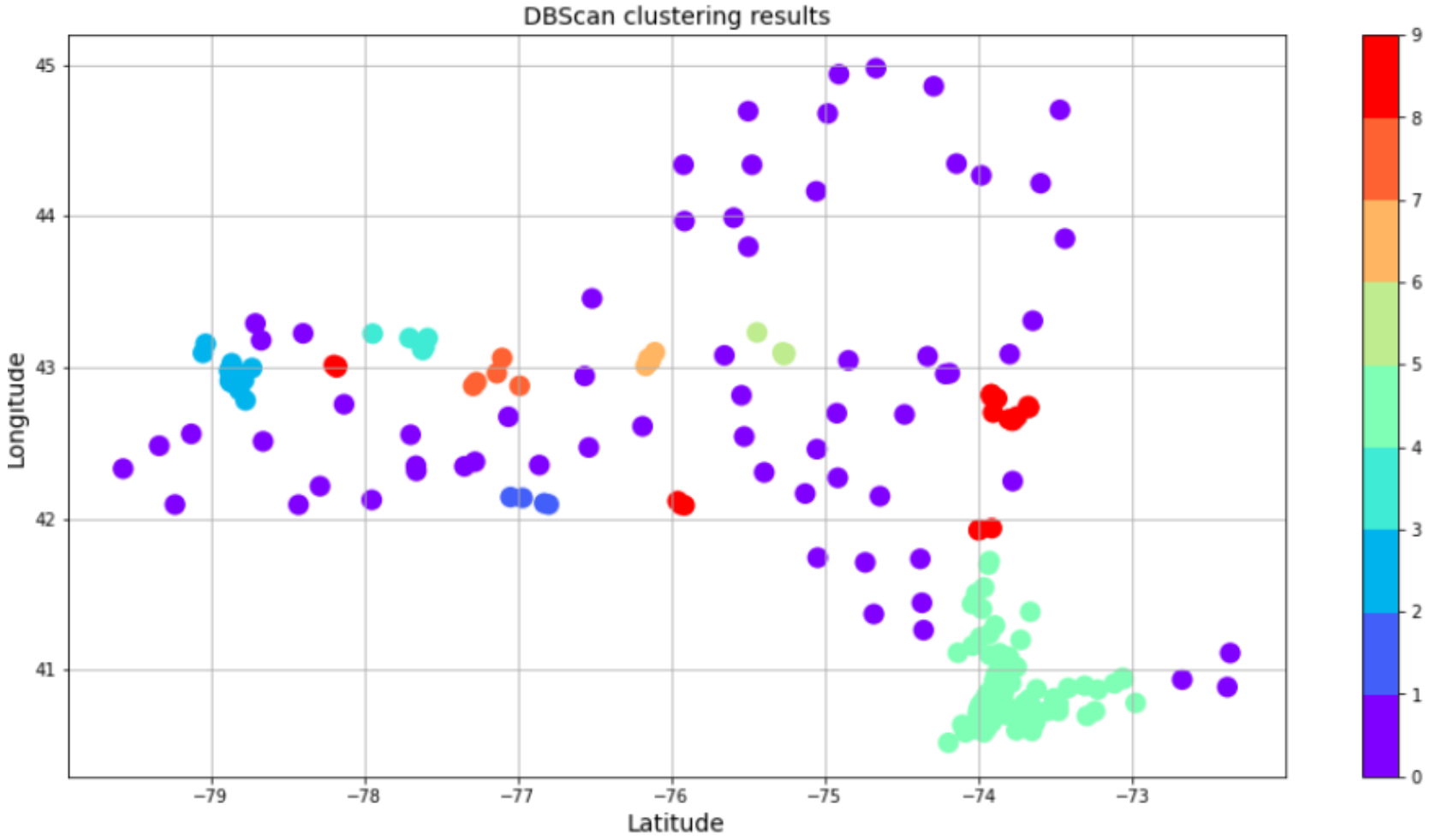


Distribution of hospitals in NYC.

5. DBScan Clustering

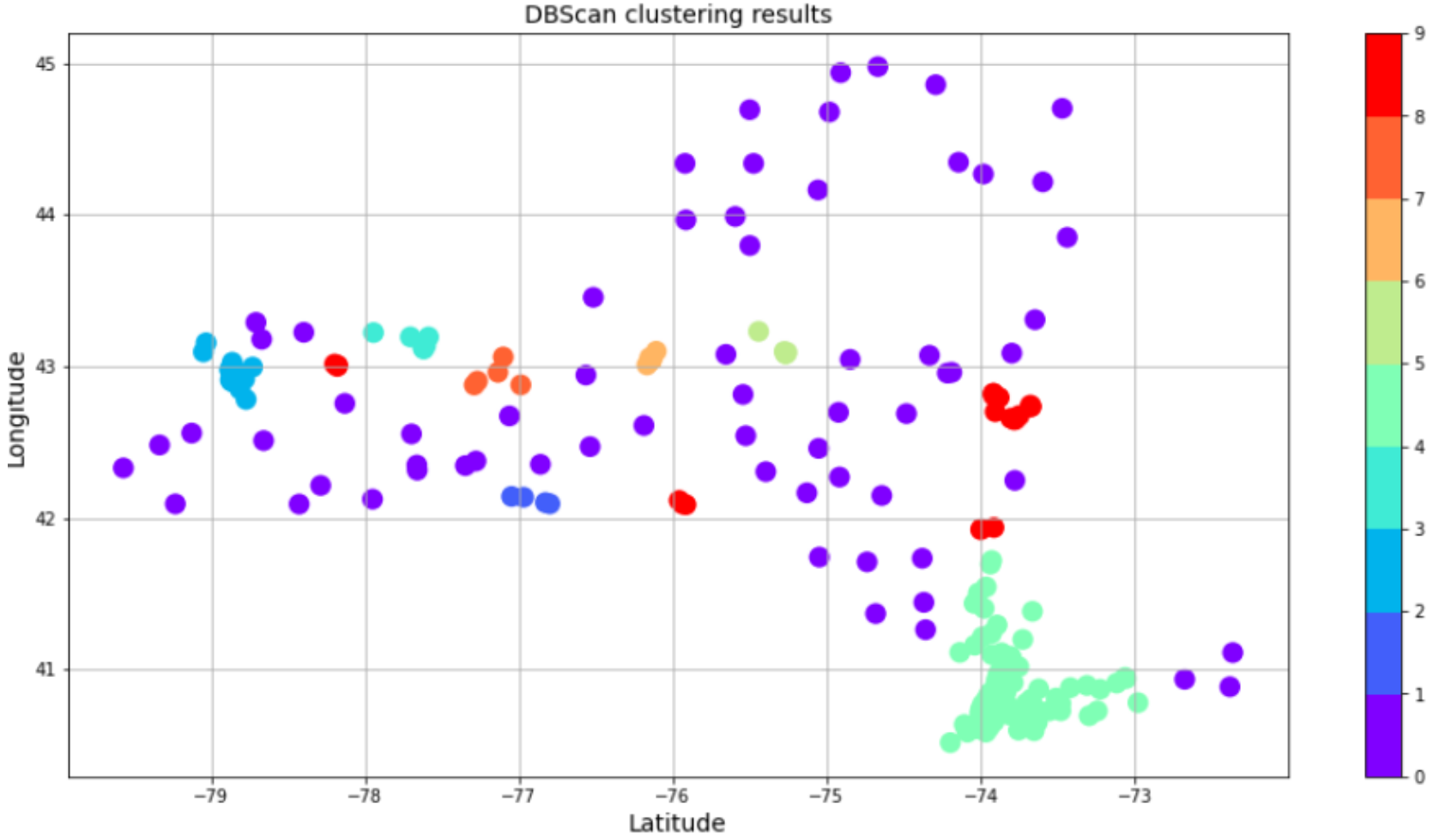
- DBScan clustering hospitals based on their location



DBScan clustering hospitals based on their location.

5. DBScan Clustering

- DBScan clustering hospitals based on their location and beds



DBScan clustering based on location and beds.

5. Conclusions

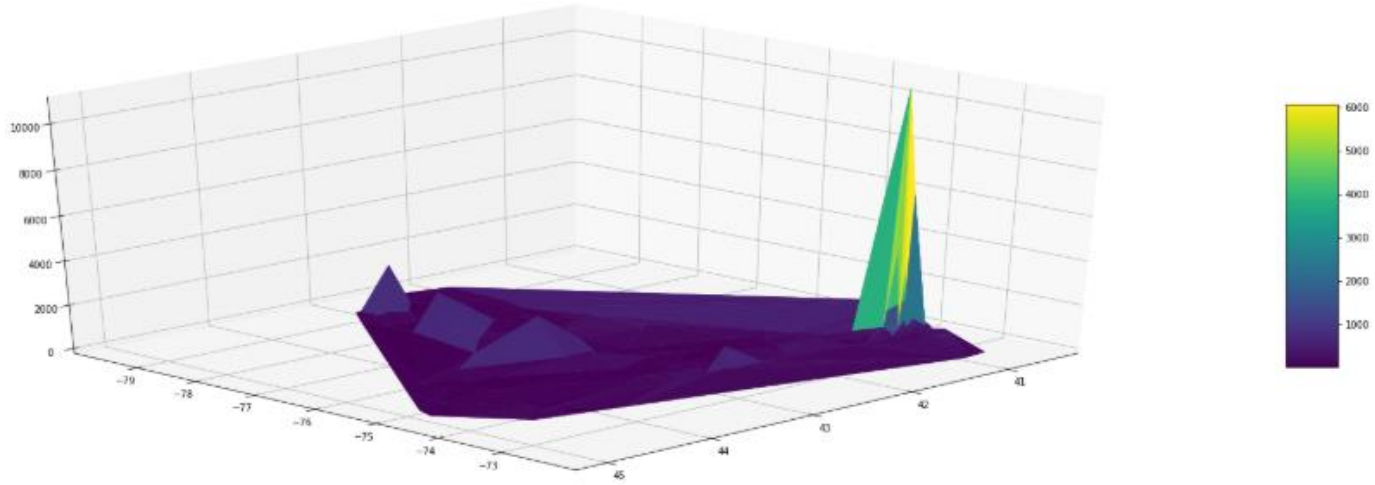
To make an analysis of the potential risk of the corona virus in a place, it is important to analyze beyond the numbers of contaminated itself. It is important to take into account the number of hospital and ICU beds, and the density of beds and contaminants. This work is an initial way to apply an optimization work for patient distribution, as explained below.

6. Future directions

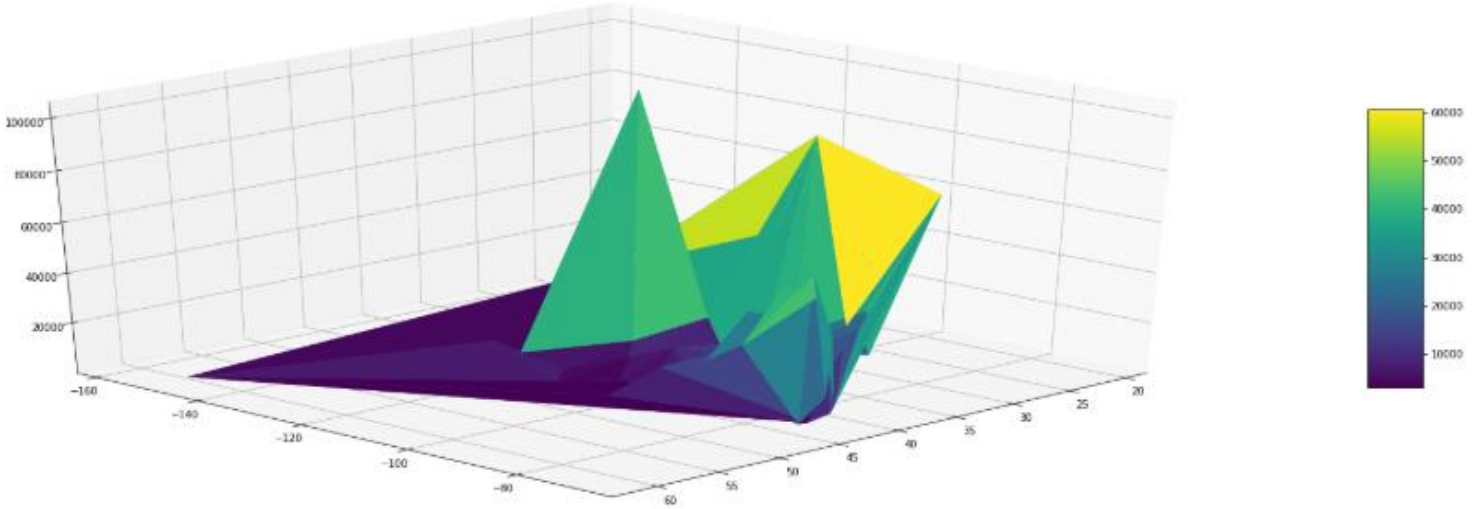
The number of contaminated, and therefore hospitalized people, grows exponentially. If the creation of hospital beds in field hospitals is not enough, it may be necessary to disperse patients to other hospitals in the region, using an optimization calculation.

The idea is to have local maximum hospital beds for each borough, State, and a global maximum for the entire US. Before reaching the local maximum of the borough, patients would be distributed to other boroughs in the same State, and before reaching the local maximum of beds in the State, patients would be distributed to reach the global maximum of US beds

6. Future directions



The 3D with Latitude, Longitude and the beds maximum capacity in the NY states, maximum local.



The 3D with Latitude, Longitude and the beds maximum capacity in the US, maximum global.

THANKS