# Covid-19 Pandemic: A Vulnerability Analysis of Massachusetts

Methodology

The Covid-19 Vulnerability Analysis Map is a composite of 5 different ranked, contributing factors: percentage of the population living in poverty, percentage of the population that is male, percentage of the population that is 65 years or older, healthcare access measured by average distance to a healthcare provider, and the May 2020 Covid-19 Case rate per town. Data on the age, sex, and poverty is normalized by population, ranked from lowest to highest contribution to vulnerability, and visualized into the map of population vulnerability rank. Health care access is measured using the Euclidian distance tool to generate raster output of average distance to health care providers, based on vector data points of their location. This output is then classified into ranks that mirror the ranking system of the population vulnerability rank. The Covid-19 case rate per town is normalized by population, transposed to the census tract administrative level, and classified into the same ranking system as the other data. All data ranks are compiled into a composite vulnerability score, which is represented in the Covid-19 Vulnerability Analysis map.

Covid-19 Vulnerability Analysis
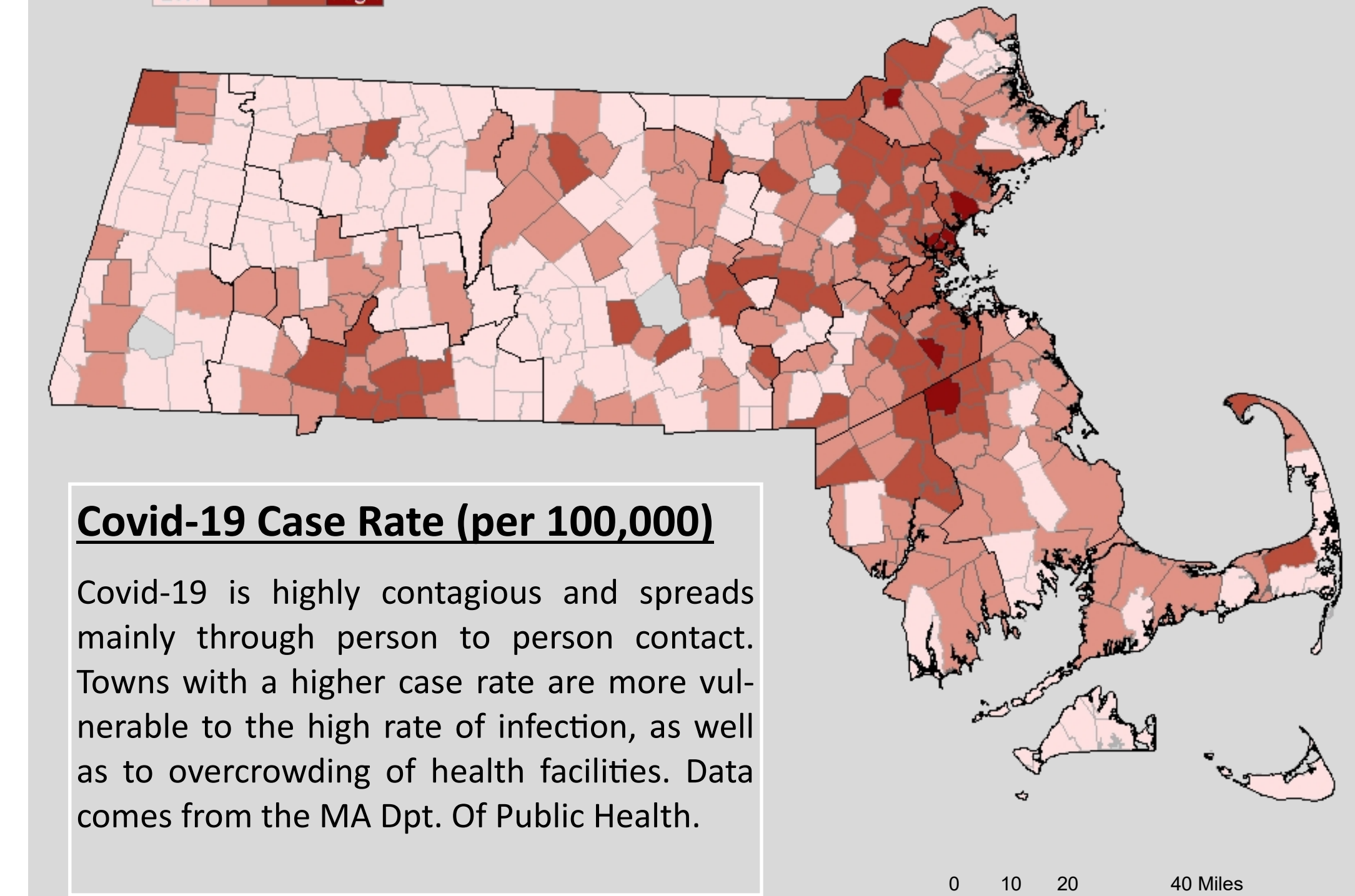
Low ▮▮▮ High
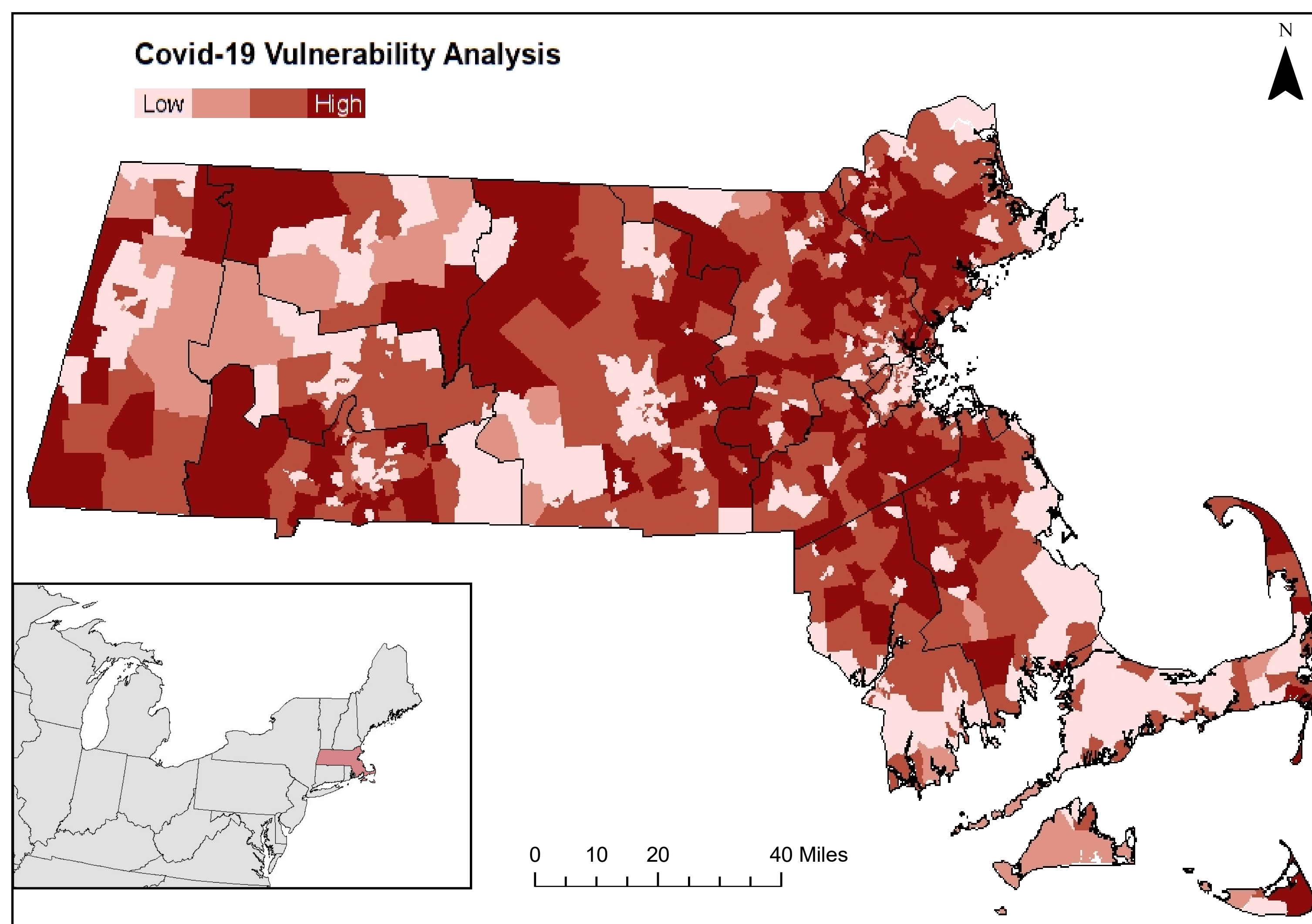
Background

On January 30th, 2020, the World Health Organization (WHO) declared the outbreak of Covid-19 to be a Public Health Emergency of International Concern (PHEIC), 7711 confirmed and 12167 suspected cases of the virus in China. Prior to this determination, only 5 PHIEC declarations have been made including the Kivu Ebola epidemic and the 2015-26 Zika Virus epidemic, both of which required no further escalation. By March 2020, the WHO declared Covid-19 to be a pandemic, after finding 117,000 cases in 114 countries. In Massachusetts alone, there are 69,08720,974 confirmed cases of Covid-19 (May 5, 2020), including 4,090 fatalities. In early April, the Boston Medical Center ICU was over-capacity and had to stop accepting new patients during overnight hours, even before the peak of the outbreak. This project aims to identify areas in Massachusetts that have greater vulnerability to the impacts of Covid-19, from a public health perspective. This vulnerability is determined by Covid-19 healthcare capacity, current Covid-19 caseload, age, sex, and poverty level—all factors identified by the CDC has risk factors for Covid-19 outcomes. Determining which areas have higher vulnerability can be important to determining which areas should receive greater funding, attention or resources as the pandemic progresses. The provision of these resources is important not only to these areas, but also to surrounding areas and beyond.
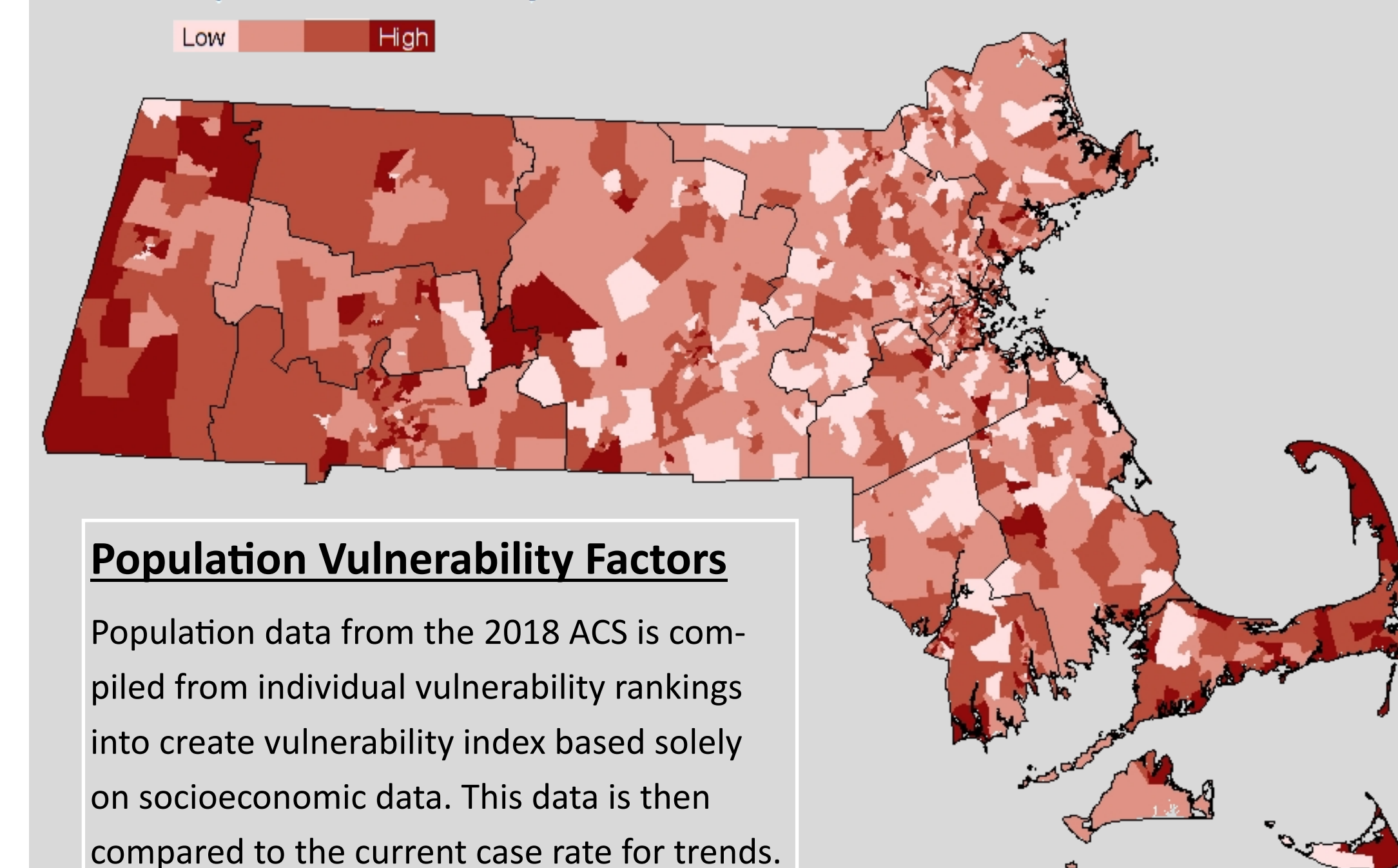
Covid-19 Case Rate per Town

Low ▮▮▮ High

Covid-19 Case Rate (per 100,000)

Covid-19 is highly contagious and spreads mainly through person to person contact. Towns with a higher case rate are more vulnerable to the high rate of infection, as well as to overcrowding of health facilities. Data comes from the MA Dpt. Of Public Health.

Population Vulnerability Rank

Low ▮▮▮ High

Population Vulnerability Factors

Population data from the 2018 ACS is compiled from individual vulnerability rankings into create vulnerability index based solely on socioeconomic data. This data is then compared to the current case rate for trends.

Conclusions

Results indicate that there are many areas, analyzed at the census tract administrative level, that have a high level of vulnerability to Covid-19 infection. These areas are spread throughout the State of Massachusetts, but there is a notable concentration in the suburbs surrounding the city of Boston. These areas seem to coincide with areas that have high population of people 65 years and older. Limitations to this project include the exclusion of data on pre-existing conditions. Some pre-existing conditions like respiratory and heart conditions have been shown to impact Covid-19 outcomes, but the data on the prevalence of these conditions is limited. Additionally, data on current case rate has become more accurate since more testing is available, but some inaccuracy could remain due to the prevalence of false negatives and asymptomatic populations.
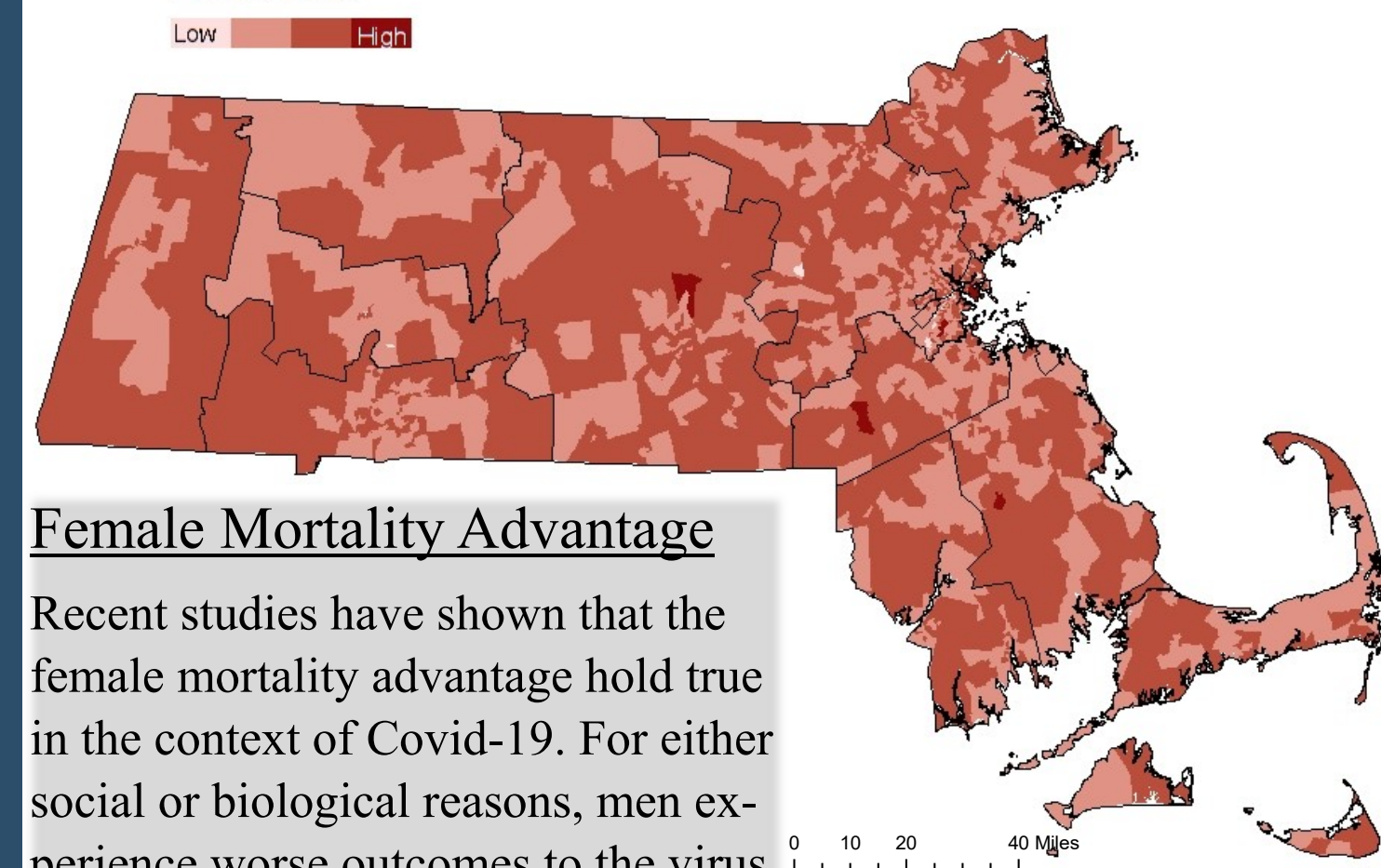
Percent in Poverty

Low ▮▮▮ High
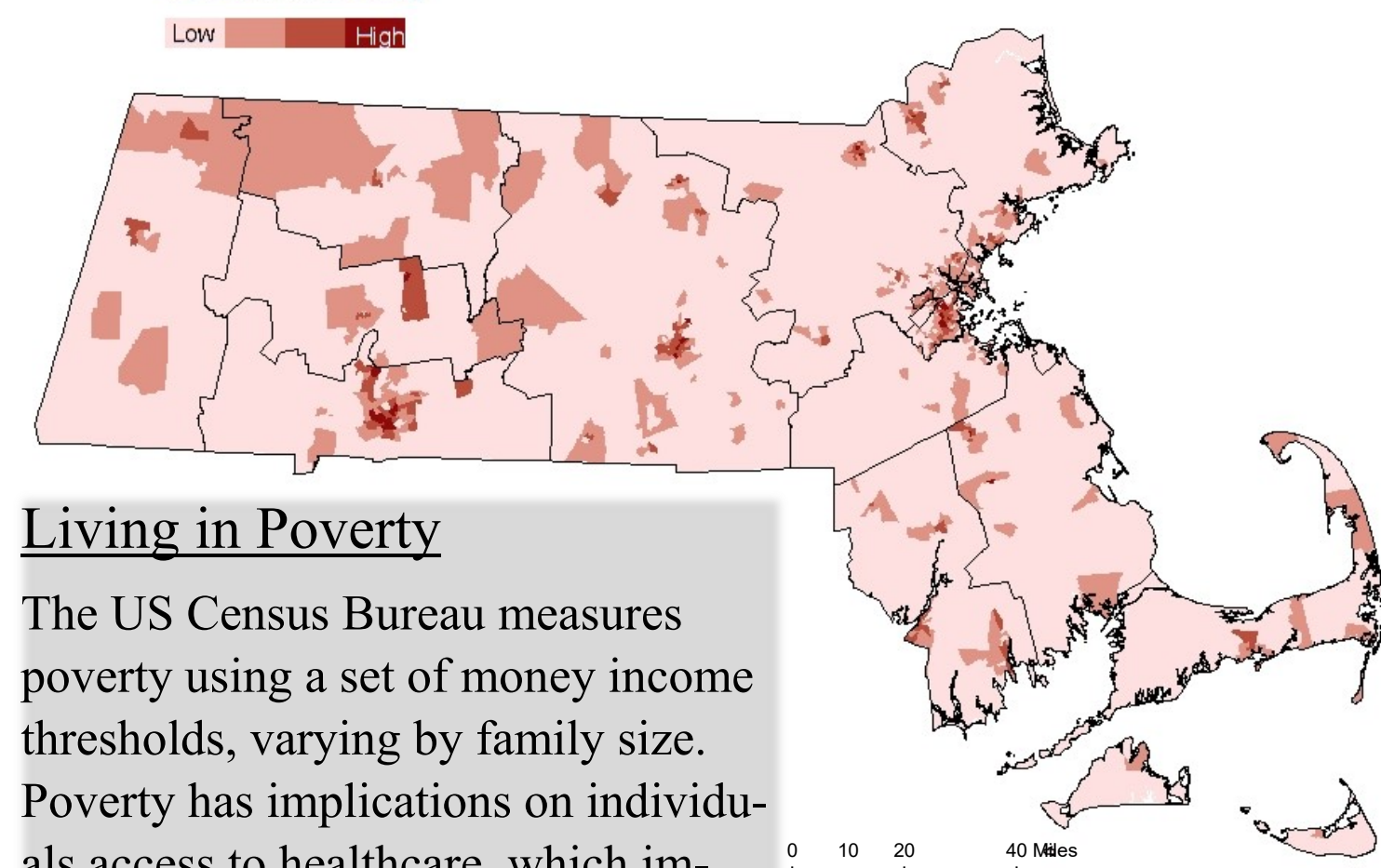
Living in Poverty

The US Census Bureau measures poverty using a set of money income thresholds, varying by family size. Poverty has implications on individuals access to healthcare, which impacts Covid-19 outcomes. Data is from the US ACS 2018 estimates.
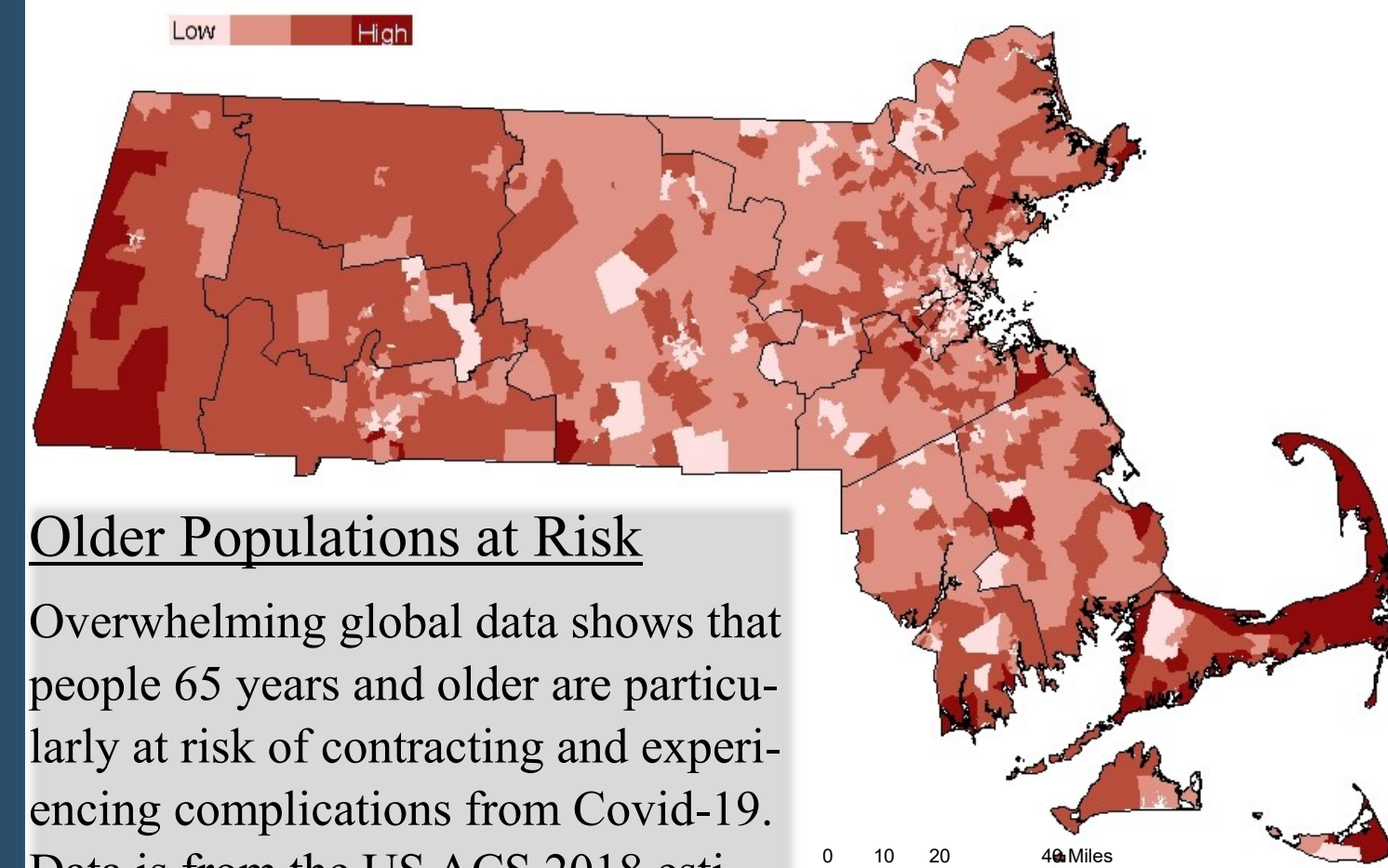
Percent Male

Low ▮▮▮ High

Female Mortality Advantage

Recent studies have shown that the female mortality advantage hold true in the context of Covid-19. For either social or biological reasons, men experience worse outcomes to the virus. Data is from the US ACS 2018 estimates.

Percent Over 65

Low ▮▮▮ High

Older Populations at Risk

Overwhelming global data shows that people 65 years and older are particularly at risk of contracting and experiencing complications from Covid-19. Data is from the US ACS 2018 estimates.