With the urbanization and industrialization that has occurred over the past century, many areas throughout the world have experienced air pollution issues. Due to emissions from motor vehicles, highways and their surrounding areas tend to have high concentrations of certain air pollutants. Exposure to many air pollutants is known to cause a variety of illnesses, including cardiovascular disease and obesity. Nitrogen Oxides (NOx) are a specific type of air pollutant that are emitted by automobiles. The term ‘NOx’ encompasses nitrogen oxide (NO) and nitrogen dioxide (NO2). NOx is correlated with other pollutants related to traffic, such as NO2 and PM, which are both EPA criteria pollutants. Therefore, NOx concentration measurements can serve as a proxy for other types of traffic related air pollution.

NOx Air Pollution data was collected by Professor John Durant’s research team in the Civil and Environmental Engineering Department at Tufts University. A mobile air quality monitoring system was driven around a mobile monitoring route at various times and dates from 2013-2015. The EJ Populations data and land use data were downloaded from MassGIS. The EJ populations data was derived from Census 2010 data by MassGIS.

To determine what populations are impacted by high levels of NOx, the interpolated NOx data from the mobile monitoring route was combined with Environmental Justice populations and land use data by using the following methods:

First, the IDW interpolation tool was used to interpolate the NOx concentration data from the mobile monitoring route. The resulting raster was inputted through the focal statistics tool in order to smooth the data and remove background noise. Next, the raster was reclassified based on quantiles into a high, moderate, and low category of NOx concentrations. This disparity is reason to investigate the extent of higher exposure marginalized groups receive. In this study, at-risk areas within Chelsea that require intervention will be identified by combining air pollution data with census and land use data.

Historically, marginalized communities are exposed to higher levels of environmental pollutants than non-marginalized groups. In the current study, experiencing a higher level of exposure is likely to lead to higher levels of sickness in these populations. This disparity reason is to investigate the extent of higher exposure marginalized groups receive. In this study, at-risk areas within Chelsea that require intervention will be identified by combining air pollution data with census and land use data.

The results of the interpolation of the NOx data collected along the mobile monitoring route can be observed in Figure 3. Figure 4 shows the locations of EJ Populations, and Figure 6 shows the locations of High Density and Multi-family Residential areas. In Figure 7, areas that are exposed to high NOx levels are shown and divided into EJ categories. The large dark purple areas identify the areas where there are high percentages of minority, low-income, and English isolated communities. This large area demonstrates the notion that marginalized people are exposed to high levels of air pollution. However, in Figure 7, which shows the areas that are exposed to high levels of NOx and have high residential densities, it can be observed that many of the areas with high NOx concentrations are not areas with a lot of people living in them. Finally, Figure 8 shows the areas in Chelsea that are exposed to high NOx concentrations, have a high residential density, and house EJ populations. The areas shown in Figure 8 identify at-risk populations of marginalized people who are exposed to high levels of NOx and other air pollutants. Because of the correlation between air pollution and cardiovascular health, an intervention in this area is recommended.

In future research, it would be beneficial to spatially analyze the correlations between air pollution, EJ populations, and health outcomes. Also, similar data exists for a mobile monitoring route in Boston, it would be interesting to compare Boston and Chelsea results. There are many limitations of this study. For example, the interpolation of the NOx data is not a perfect representation of the air pollution level in the areas between the mobile monitoring route data. The areas far away from the route are subject to high levels of uncertainty. Also, the high category of NOx concentration is not necessarily the level of concentration that is dangerous to human health, but since NOx correlates with other air pollutants, the high NOx areas likely have levels of NOx, PM2.5, and other traffic related air pollutants.

The people who live in areas with high levels of air pollution are at a greater risk for contracting a cardiovascular disease. For this reason, it is important to monitor air pollution and to prevent marginalized communities from being disproportionately exposed.