An Assessment of Bicycle Injuries in New York City

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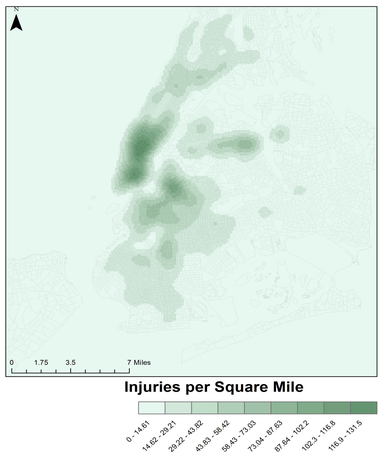
Introduction

In 2014, New York City implemented Vision Zero: an effort to decrease the number of traffic-related fatalities involving motor vehicles, cyclists, and pedestrians throughout the five-boroughs. These ongoing initiatives consist of reduced speed limits, enforcement measures, public outreach, and street improvement projects. According to the New York City Department of Transportation (DOT), fatalities have fallen as a result of this project. However, another outcome of interest is bicycle injuries. Many factors have led to increased ridership over the past decade, and with that, high injury counts.

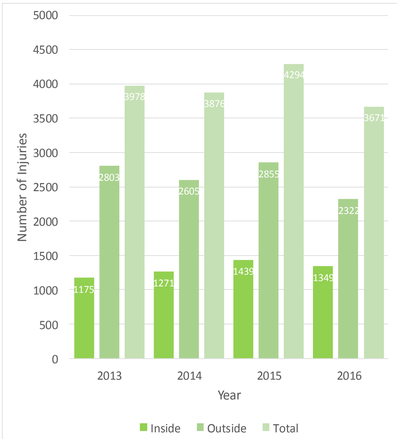
Through shapefiles provided by the Department of Transportation (DOT) and census population data, I use various spatial analysis methods to explore the relationship between NYC's built environment and bike incidents resulting in injury. I seek to visually represent and analyze the following questions:

- Where are the most bicycle injuries occurring?
- Is there clustering where these injuries are occurring? If so, has this clustering changed pre- and post-Vision Zero efforts?
- In which community board districts should future infrastructure be prioritized?
- What is the efficacy of the current infrastructure in place?

Cycling Injuries Per Square Mile

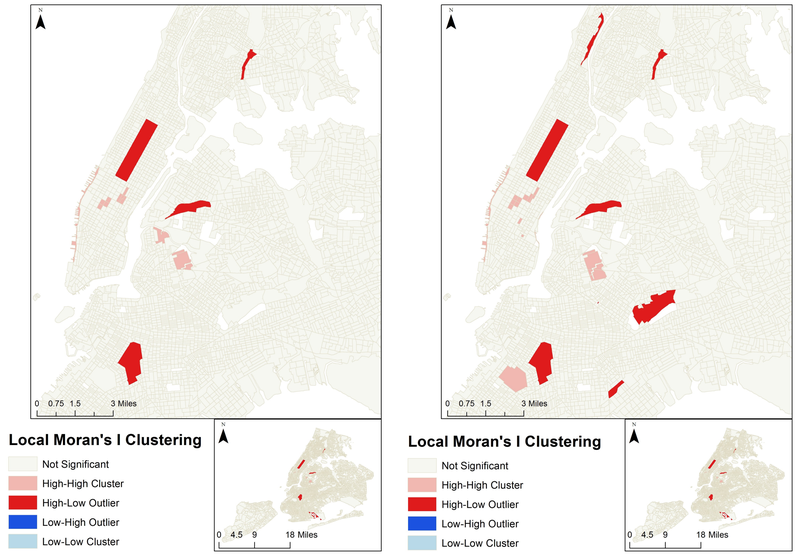


Bicycle Injuries by Year



Left: Kernel Density map depicting the number of bicycle injuries per square mile in New York City in 2016.

Right: Bar chart depicting the number of cycling injuries both inside and outside of cycling infrastructure (bike lanes, signed routes, etc.)



Clustering of Bicycle Injuries in 2012 and 2016

Methods

The Kernel Density map was created using injury data of various types over a course of many years. I created a new layer with only 2016 bicycle injury data, and utilized the Kernel Density spatial analysis feature to visualize bicycle injury hotspots by square mile.

The Moran's I maps were created via a spatial join of the bike injury data to census blockgroups, calculations to find an injury rate, an attribute query to include areas only where population was greater than zero, and the cluster and outlier analysis spatial statistics tool to indicate areas with high bicycle injury clustering.

The table and chart were created through a series of spatial queries of injuries that intersect the bike lanes that were available during the years in question, and the statistics function in the attribute table for the selected data.

I used the available data provided by the NYC DOT to create the choropleth map of community boards with the highest injury rates. The information used was the sum of bicycle injuries, with the data already normalized by population.

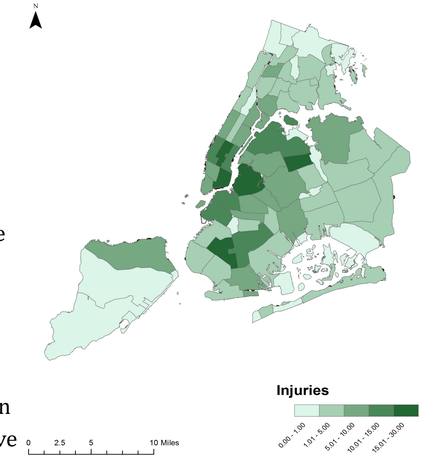
Discussion & Limitations

Infrastructure Type	Number of Injuries	Total Miles	Injuries per Mile
Protected Lanes and Paths	249	385.8	0.69
Exclusive Bike Lanes	621	377.5	1.64
Shared and Signed Routes	466	246.9	1.89
Other	13	-	-
Total	**1349**	**1010.2**	**4.22**

Bike Injuries by Infrastructure Type

The cluster analysis shows significant injury rate clustering in 2012 before Vision Zero was implemented, and they were still clustered as of 2016, with some high-high clusters in the same locations. The bar graph indicates that the number of injuries has fluctuated over the past four years, but the levels are generally sustained, with fewer injuries occurring in bike lanes and other bicycle infrastructure than outside of them. Sufficient conclusions cannot be drawn about the efficacy of Vision Zero, as this could be a result of increased ridership, which can also explain the generally rising number of overall bike lane injuries, as injury rate was not taken into consideration.

Injuries by Community District



Because community boards are often consulted by the DOT, those who have jurisdiction over the areas with high clustering rates and injury rates in general should work to prioritize infrastructure that will further reduce the current and persisting number of cycling injuries, paying attention to the infrastructure that appears to be the most effective.

There were several limitations, including the unavailability of some data, such an annual cyclist count and bike lane mileage, which can work to make normalization for some relationships difficult. Additional limits to the data include a lack of in indication of injury severity, which could be helpful in further prioritizing areas for infrastructure or legislation. This analysis also does not take into consideration other potential legislation or infrastructure types that can impact these injury rates apart from bike lanes. Finally, although standard bike lanes are relatively inexpensive to implement, a cost analysis has not been conducted.

Coordinate System: NAD_1983_StatePlane_New_York_Long_Island_FIPS_3104_Feet

Projection: Lambert_Conformal_Conic

GIS 101: Introduction to GIS

Date: May 9, 2017

Data Sources: NYC Department of Transportation, US Census, ESRI

References: Li Chen, Cynthia Chen, Raghavan Srinivasan, Claire E. McKnight, Reid Ewing, and Matthew Roe. Evaluating the Safety Effects of Bicycle Lanes in New York City. American Journal of Public Health: June 2012, Vol. 102, No. 6, pp. 1120-1127. doi: 10.2105/AJPH.2011.300319

NYC Department of Transportation. (2017). *Cycling in The City: Cycling Trends in NYC* (pp. 1-24, Rep.). New York: New York City Department of Transportation.