Basch CH, Ethan D, Fera J, Kollia B, Basch CE. Micromobility Vehicles, Obstructions, and Rider Safety Behaviors in New York City Bike Lanes. *J Community Health*. 2023;48(3):522-527. doi:[10.1007/s10900-023-01197-6](https://doi.org/10.1007/s10900-023-01197-6)

* Purpose of the study was to observe protected bike lanes, user’s behaviors, and responses to obstructions
* Cross-sectional observational study at 10 “zones” in New York City
* 998 micromobility vehicles were observed, mostly regular Citi Bikes and regular and electric bicycles
* helmet use was uncommon (~25%), but more common among those with personally owned vehicles than Citi Bike users
* 232 riders encountered and obstruction, 82% of which were cars/vehicles in the bike lane. 88% of those reacted by riding into the traffic lane

Chen L, Chen C, Srinivasan R, McKnight CE, Ewing R, Roe M. Evaluating the safety effects of bicycle lanes in New York City. *Am J Public Health*. 2012;102(6):1120-1127. doi:[10.2105/AJPH.2011.300319](https://doi.org/10.2105/AJPH.2011.300319)

* Purpose of this study was to evaluate the effect of bike lanes on different categories of crashes in New York City
* Methods: identify comparison and treatment groups of road segments and intersections with and without bikes lines. Distinguish between 5 types of crashes: total, multiple vehicle, bicyclist, pedestrian, injurious or fatal
* The total amount of crashes did not increase after bicycle lane installation, however the number of bicycle-involving accidents did increase, largely because of increased volume of cyclists

Cicchino JB, McCarthy ML, Newgard CD, et al. Not all protected bike lanes are the same: Infrastructure and risk of cyclist collisions and falls leading to emergency department visits in three U.S. cities. Accid Anal Prev. 2020;141:105490. doi:10.1016/j.aap.2020.105490

* Purpose was to examine risks associated with protected bike lanes for crashes leading to ED visits
* Methods: Prospective study of patients in ED departments in 3 cities who fell or crashed while cycling. Data on crash sites was identified and coded for presence and type of bike lane/infrastructure
* 604 cyclists/crashes were included. Compared to unprotected major roads, most bike lanes had lower odds of crashes. Lanes with light separation (especially two-way bike lanes) had significantly higher odds of crashes. Streetcar/train tracks also significantly increased crash risk

Garber MD, Watkins KE, Flanders WD, et al. Bicycle infrastructure and the incidence rate of crashes with cars: A case-control study with Strava data in Atlanta. J Transp Health. 2023;32:101669. doi:10.1016/j.jth.2023.101669

* Purpose was to estimate the incidence rate of crashes and compare risk based on the type of infrastructure present
* Methods: case-control study over 23 month period in Atlanta (2016-2018). Cases were crashes, control data was based on data from Strava combined with on the ground bicycle counters
* Estimated 336 million bicycle kms were ridden, 9.2% reported by strava. Incidence of crashes was 3.7 per million km
* Protected and buffered bike lanes had significantly lower rates of crashes after adjustment. Conventional bike lanes had higher incidence of crashes. The effects varied on segments and intersections, so the type of road segment also influenced the crash risk.

Kondo MC, Morrison C, Guerra E, Kaufman EJ, Wiebe DJ. Where do bike lanes work best? A Bayesian spatial model of bicycle lanes and bicycle crashes. Saf Sci. 2018;103:225-233. doi:10.1016/j.ssci.2017.12.002

* Purpose was to identify locations where bike lanes, if installed, could reduce crash rates
* Methods: Bayesian autoregressive logit models to relate the odds that a crash occurred to the characteristics of the street/intersections. Philadelphia from 2011-2014.
* 2,052 injuries occurred on 37,673 street segments. Only 220 segments had >=2 crashes, and most street segments with crashes were concentrated in center city area
* 10% of segments had a bike lane
* Bicycle lanes had the greatest protective effect at intersections with 4 exits and those with 1 or 2 stop signs

Lusk AC, Morency P, Miranda-Moreno LF, Willett WC, Dennerlein JT. Bicycle guidelines and crash rates on cycle tracks in the United States. *Am J Public Health*. 2013;103(7):1240-1248. doi:[10.2105/AJPH.2012.301043](https://doi.org/10.2105/AJPH.2012.301043)

* Purpose was to determine whether bike lanes were built in different areas and their crash rates
* Methods: bike lanes identified via survey and web searches. Data were collected by soliciting local professionals for information on crashes in their communities
* 19 bike lanes met inclusion criteria and had all data available in 8 states. The type of bike lane varied
* 55 bicycle-vehicle crashes were reported over 57 total years of observation. Some lanes had 0 crashes. The overall crash rate was 2.3 per 1 million bicycle kilometeres.
* Crash rates in New York City bike lanes ranged from 0-7.2/million km

Morrison CN, Thompson J, Kondo MC, Beck B. On-road bicycle lane types, roadway characteristics, and risks for bicycle crashes. *Accident Analysis & Prevention*. 2019;123:123-131. doi:[10.1016/j.aap.2018.11.017](https://doi.org/10.1016/j.aap.2018.11.017)

* Purpose was to identify types of bike lanes associated with reductions in bike crashes given specific roadway characteristics
* Methods: spatial data from the road and bike network of Melbourne, Australia were analyzed. Crashes were geocoded to intersections. Data on bike lane presence, roadway characteristics, and crash type were also collected. Bayesian autoregressive models were fit to estimate the odds of observing a crash
* 62% of crashes occurred at intersections (vs. street segments). 2.9% of spatial units (intersections and segments) had a crash over a 3 year period.
* Bike lanes of all types were associated with lower crash odds when speeds were greater, bus stops were present, and traffic lanes were narrower. Exclusive bike lanes were associated with reduced crash odds in all settings.

Mulvaney CA, Smith S, Watson MC, et al. Cycling infrastructure for reducing cycling injuries in cyclists. *Cochrane Database Syst Rev*. 2015;2015(12):CD010415. doi:[10.1002/14651858.CD010415.pub2](https://doi.org/10.1002/14651858.CD010415.pub2)

* Purpose was to evaluate the impact of cycling infrastructure and cyclist injuries
* Methods: review of previously published studies
* 21 studies were included. Interventions included bike lanes (lanes, paths, and tracks are distinguished and considered), signalized and priority junctions, roundabout design, and combined packages of interventions
* Many studies had risk of confounding, but from the studies available there was insufficient evidence to say that cycling infrastructure reduced the risk of injuries in cyclists

Nolan J, Sinclair J, Savage J. Are bicycle lanes effective? The relationship between passing distance and road characteristics. *Accid Anal Prev*. 2021;159:106184. doi:[10.1016/j.aap.2021.106184](https://doi.org/10.1016/j.aap.2021.106184)

* Purpose: measure the predictors of passing distance given to bicycles by passing vehicles.
* Methods: data was collected via a device worn by cyclists which detected the distance of passing vehicles
* 46,769 passing events occurred by 162 cyclists on 6448 road sections. The average passing distance was 170 cm
* Protected bike lanes and wide painted buffers significantly increased passing distances, and reduced odds of passing less than 1 meter away, compared to painted or no bike lane

Wall SP, Lee DC, Frangos SG, et al. The Effect of Sharrows, Painted Bicycle Lanes and Physically Protected Paths on the Severity of Bicycle Injuries Caused by Motor Vehicles. *Safety (Basel)*. 2016;2(4):26. doi:[10.3390/safety2040026](https://doi.org/10.3390/safety2040026)

* Purpose was to assess whether bike lanes of various types reduce injury occurrence and severity
* Methods: prospective study of injured cyclists in New York City. Crash data were collected through patient and EMS interviews. Incident locations were geocoded with they type of bike route
* Physically protected paths were associated with 23% fewer injuries. Painted bike lanes reduce injury risk by 90%
* Injuries that did occur were more likely to be moderate, severe, or critical in shared, on-road bike lanes. Protected and painted lanes were associated with mild injury
* Note: they have some nice figures showing crash location, severity, and bike lane type and location, with cluster analysis that may be useful models for my analysis

Thoughts:

* Many articles distinguish between different types of bike lanes, which will be important for my project
* They also frequently distinguish between road segments and intersections. Considering how to handle those will be an important decision
* Overall the evidence for the safety of bike lanes is mixed. Crashes sometimes increase following bike lane installation, but ridership also increases dramatically. So adjusting for counts/usage will be crucial. Time periods covered are also important, in case a bike lane was built during the observation period