# Pedestrian Safety on Chicago Roads

AUTHOR
Alison Filbey (Section 4; alisonfilbey) and Claire Conzelmann (Section 4; claireconzelmann)

PUBLISHED
December 5, 2024

## Introduction

Over the past decade, traffic fatalities among pedestrians and bicyclists have increased substantially in Northeastern Illinois. In 2014, there were 400 pedestrian fatalities in this region; in 2023, the number of pedestrian fatalities had increased to nearly 600 (CMAP 2024). Due to this rise in traffic fatalities, the state of Illinois is considering lowering the statutory speed limit in urban areas from 30 mph to 25 mph. If adopted, this measure would decrease the speed limit on most city roads within Chicago.

Using traffic crash report data from the city of Chicago, our project seeks to answer two main questions:

- Does the crash report data suggest that lowering the statutory speed limit from 30 mph to 25 mph would reduce severe pedestrian involved crashes?
- Are there other ways the city of Chicago can reduce severe pedestrian injuries resulting from crashes?

## Data and Methods

To conduct our analyses, we use the Traffic Crashes datasets from The Chicago Data Portal. Specifically, we use the crashes dataset, which has information on traffic crashes from September 2017-October 2024. The crahses dataset is at the crash record level and includes information such as the location of the crash, the cause of the crash, and the speed limit on the road of the crash. We also use the people dataset, which contains information on the people (both within and external to the vehicle) involved in each crash and the injuries they sustained. Because it is at the person level, there are multiple observations per crash. Lastly, we use the Chicago roads shapefile and the Chicago community area shapefile, also from the Chicago Data Portal.

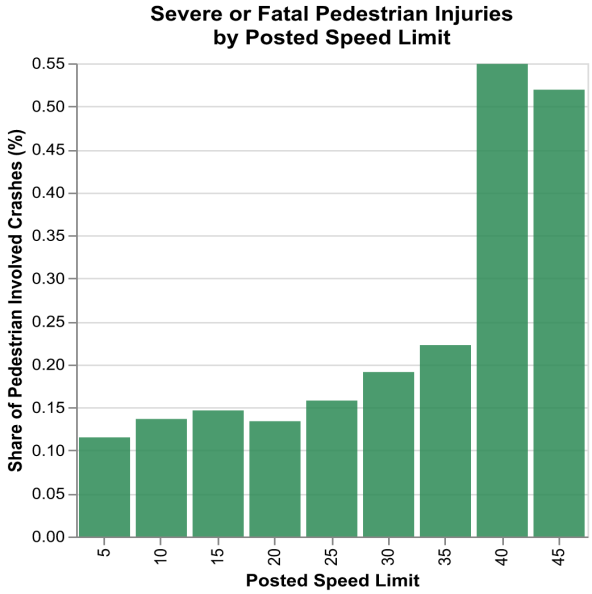
Because previous research suggests that severe and fatal pedestrian traffic crash injuries have increased in recent years, we focus our analysis on these specific crashes. To do so, we first subset the people dataset to observations where the person type is coded as “pedestrian”. To calculate severe pedestrian crashes, we subset our people dataset to pedestrians who had an injury classification coded as “incapacitating injury” or “fatal”. We aggregate both the pedestrian and severe pedestrian subsets to the crash level by counting the total number of observations (pedestrians) belonging to each crash record. We then merge both subsets to the crash dataset on the unique crash record id. Some of our analyses look at the share of pedestrian crashes that caused severe injuries. To calculate the share, we simply divide the number of severe pedestrian injuries by the total number of pedestrians invovled in crashes (at some level of aggregation, such as posted speed limit, road, etc.).

For the Shiny app, we calculate the number of severe crashes on each road within a neighborhood. To do so, we first spatially join the community area shapefile to the road shapefile so that we can join the community area name to the roads. Then, we subset the road and community area geodataframes to the

community area inputted by the user. To join the road names in the road data to the crash points in our crash data, we first create a 0.00025 degree buffer around each road. Then, we spatially join the crash data to the road buffers using the "within" method. The buffer allows us to capture the crash points that happen along a given road. We then group by the road name and calculate the number of crashes on each road. To calculate the number of sever crashes within each neighborhood, we spatially join the community areas to the crash data, so that we can join the community area name to each crash point. This allows us to subset to the inputted community area, group by community area, and count the number of crashes within each area.

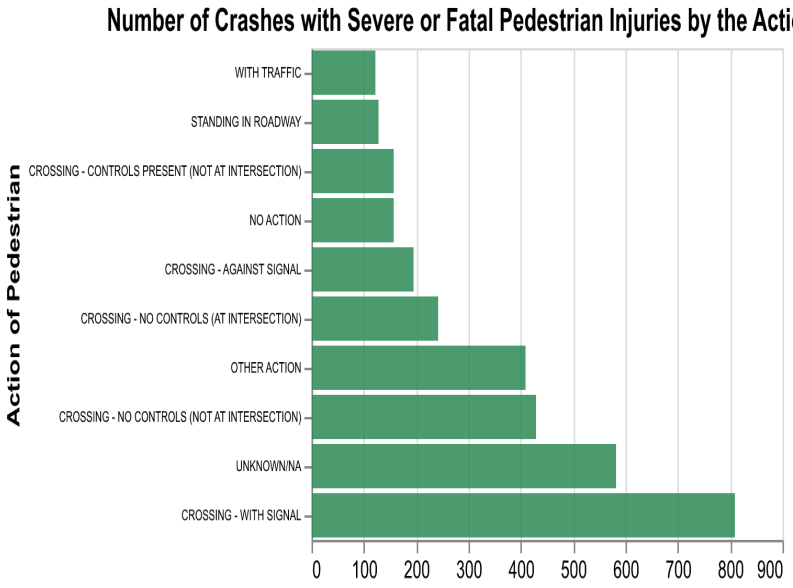
## Results

First, we were interested examining the relationship between posted speed limit and severe pedestrian crashes. We looked at the percentage of total pedestrian crashes that were severe or fatal by posted speed limit, binning the speed limits into increments of five. We looked at the share of severe crashes to account for the fact that becuase the majority of Chicago roads have a speed limit of 30mph, which may skew our results.



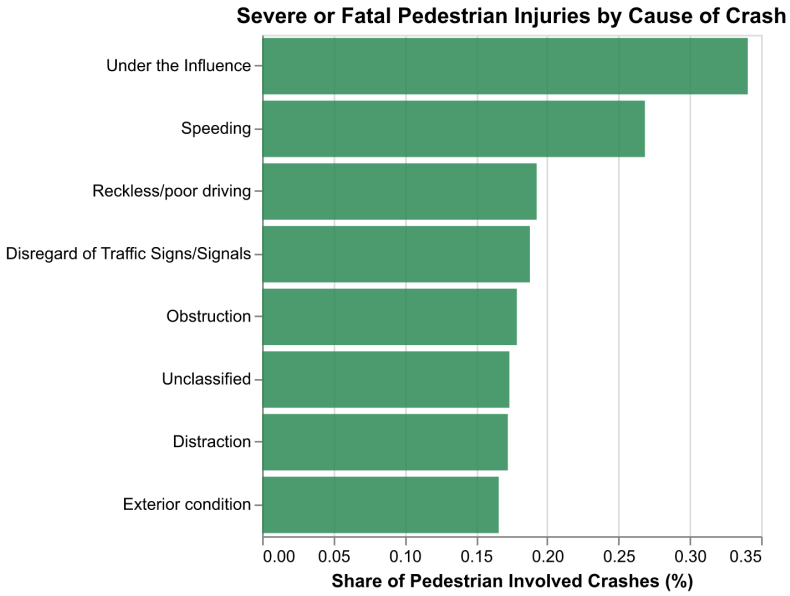

As seen from the figure, the share of severe pedestrian injuries from crashes increases with the posted speed limit. The share of severe pedestrian injuries doubles when the posted speed limit increases from 35mph to 40mph. As we are interested in the impact of the change of the statutory speed limit from 30 mph to 25 mph, it is interesting that the share of severe pedestrian injuries does not really increase between 25 to 30 mph, telling us that this speed limit change may not drastically impact the number of pedestrian injuries. Therefore, we next wanted to look at other factors that could contribute to the severity of pedestrian injuries from crashes.

As what the pedestrian was doing at the time of the crash could also have large impact on the severity of their injuries, we next turned the ten most common actions of pedestrians that result in severe or fatal pedestrian injuries.




The figures shows that crossing with signal had the highest number of crashes involving pedestrians. This was approximately double the number of crashes with severe injuries for all other documented actions (excluding NAs). As it seems as if pedestrians are obeying traffic laws and this is still resulting in severe injuries, we next wanted to look to the action of the car driver, focusing on the cause of the crash.

Looking towards the cause of the car crash, after grouping the causes into eight categories, we examined the percentage of total pedestrian injuries were severe or fatal by cause of the crash.




From the figure, it is clear that both driving under the influence and speeding were most directly correlated with severe pedestrian injuries from crashes, while the other six causes had roughly the same severity. This is an interesting finding because clearly speeding is having a large impact on the share of severe pedestrian injuries. Connecting this back to our first visualisazation, the share of severe pedestrian injuries by posted speed limit, an important question remains - are drivers more likely to cause severe pedestrian injuries at higher posted speed limits, or are drivers more likely to speed at higher posted speed limits, which in turn leads to a higher share of severe pedestrian injuries?

Finally, we created a Shiny app dashboard. Utilizing the Chicago community areas shapefile and roads shapefile, we created a dashboard that allows a user to select a neighborhood to display a map of the neighborhood roads colored by the number of severe pedestrian injuries on each street and a map of all Chicago neighborhoods colored by the number of severe pedestrian injuries. At the top, a table displays the three most dangerous streets for pedestrians in each selected neighborhood as well as the number of severe pedestrian injuries and posted speed limit on the road. The dashboard is useful for pedestrians to determine which neighborhoods and which roads within neighborhoods are safer for pedestrians as well as policymakers to determine which neighborhoods and roads need to be targeted for pedestrian safety policy changes.

## Recommendations

Based off of our investigation, we have several recommendations for the city of Chicago. First, as our visualizations show that speeding plays a leading role in causing severe pedestrian injuries from crashes, we recommend implementing road diets, or reducing the number of lanes on roads, which makes it harder to speed. We recommend this for roads with heavy pedestrian traffic or more severe pedestrian injuries. This can also include narrowing lanes and adding a larger shoulder or bike lanes or wider sidewalks to make it safer for pedestrians and cyclists

Our second recommendation is based off the finding that the largest number of severe pedestrians injuries happen when they are legally crossing at marked intersections. Therefore, we suggest that speed monitoring devices should be added to roads with heavy pedestrian traffic. Implementing signals or alert devices on roads so that drivers know when they are speeding or so that they know they are approaching an intersection where pedestrians are crossing is essential for reducing the number of severe pedestrian injuries.

## Conclusion

In conclusion, we have begun to uncover some potential causes for severe pedestrian injuries from crashes and develop some possible recommendations for the city of Chicago. As this is just a preliminary investigation, future work should involve conduting randomized control trials with our recommendations listed above to determine which policy interventions are most effective at reducing pedestrian injuries from crashes. Additionally, our data was rather limited. For example, while we had the posted speed limit, we do not have data on the speed of the driver at the time of the crash. Using other data, such as traffic cameras at intersections, to study pedestrian-involved crashes in more detail would be benefifical to understand the root causes of these incidents.

## References