Road Safety in Toronto

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1 Introduction

Working Paper

This is not the final report.

This research was originally motivated by the question of whether Toronto streets safe for pedestrians and cyclists. We can understand Toronto's relative safety by comparing to other cities. Because many cities began recording cyclist and pedestrian fatalities online starting in the 2000s, it is possible to obtain longitudinal mortality data.

- historical trends can be helpful for predicting the future
- comparisons between cities can also be helpful
- there are many factors that contribute to road safety
- the per-capita adjustment for mortality statistics can help for between-cities comparison

2 Methods

Toronto pedestrian and cyclist fatality data were collected for the 7-year period of 2009-2015. Similar data were collected for comparable cities. The cities in this study are:

- Amsterdam
- Chicago
- Copenhagen
- London
- Los Angeles
- New York City
- Toronto

2.1 Data Fields

The following data fields were collected for each year and city in this study:

- city
- metro area population
- year
- number of pedestrian fatalities in each year
- number of cyclist fatalities in each year

In addition to raw fields, citation data were collected for each observation. These data are stored as Comma Separated Values, and the resulting CSV file is available for download.

2.2 Population and Road Use

We collected both city population and metro area population for consideration. Estimates provided by Wikipedia were held constant across all years for each city. City populations ranged from 0.6 million to 8.7 million (14.5:1), whereas metro area populations ranged from 2.0 million to 23.7 million (11.85:1). Between these population measures, the metro area population results in a less extreme ratio among cities. It is a common pattern for people to commute to cities during the workday even though they do not live in the city. For these reasons, Metro area population is used as an indicator of road use. Larger metro areas will generate more trips, so it will be a better proxy for actual traffic and, therefore, opportunities for automobile, pedestrian, and cyclist interactions. Yearly *per capita* fatality rates were calculated based on Metro Area populations, and are reported as rates per 100,000 residents throughout the results.

2.3 Data Collection Challenges

The task of data collection presented several challenges: 1) language translation; 2) local traffic safety data reporting policies; and 3) length of historical record.

The issue of language can be overcome with automated translation software. Traffic safety data varies across international jurisdictions due to subtle differences in the definition of key terms like “collision” and “cyclist.” Another factor affecting the traffic safety record is the agency responsible for recording that data. In the case of the City of Amsterdam, this responsibility shifted from the police to the health system, resulting in a “hiccup” in the available data during the transition. In other cases, city-wide traffic mortality data were not stratified by transit method to permit the differentiation of cyclists from pedestrians. These factors, combined, limit the number of years of data available for various cities.

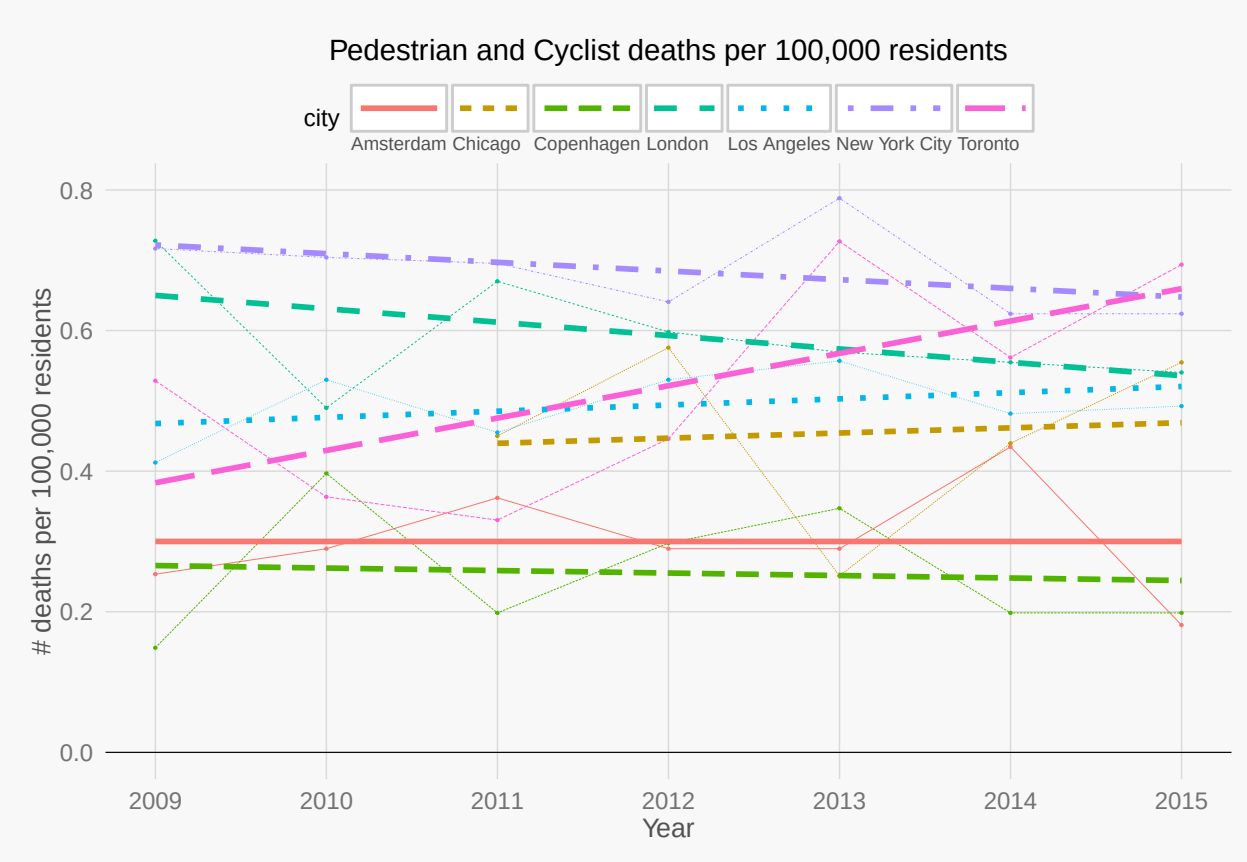


Figure 1: The trend line for each city is fit to the raw values with a mean-squared error method

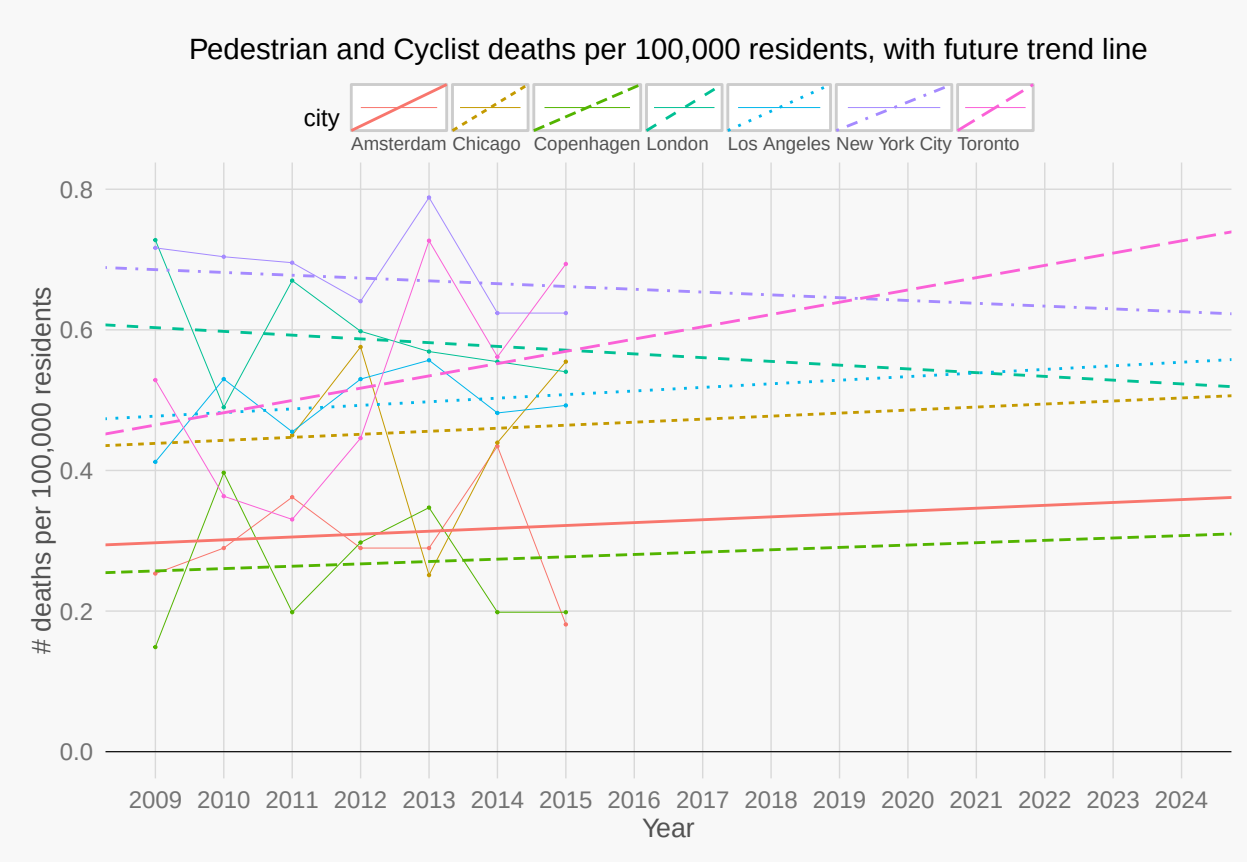
2.4 Reproducibility

The R Statistical Environment was used for analysis and plotting. All scripts used to generate this report are available online: https://github.com/iandennismiller/road-safety/. Together with the raw data, which are available from the same source, this report may be reproduced.

3 Results

The rate of pedestrian and cyclist fatalities per 100,000 residents are plotted in Figure 1.

3.1 Trends



3.2 Direct Comparison: NYC and Toronto

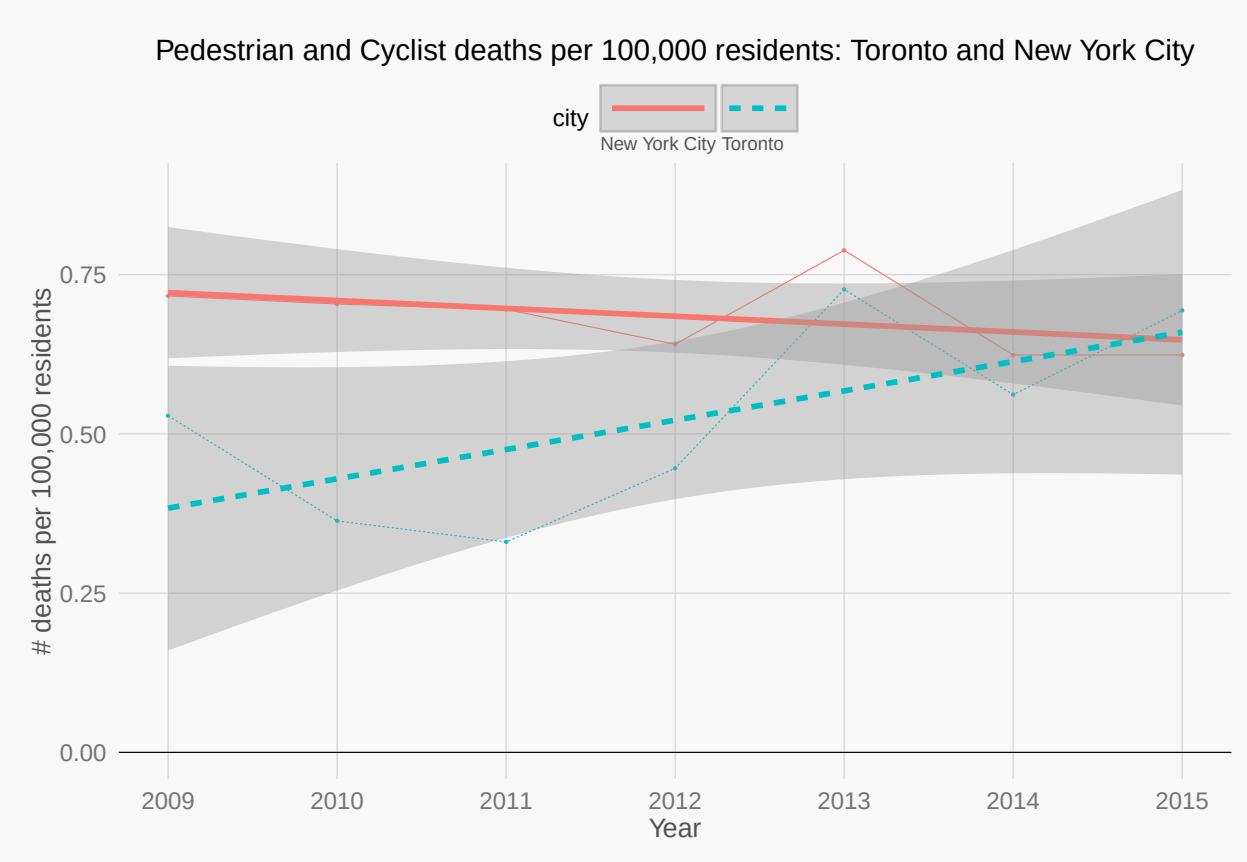
95% confidence intervals have been added around the trend lines, enabling direct comparisons between cities.

In 2009, New York City had the greatest pedestrian and cyclist fatality rate among all cities included in the study. Toronto caught up to New York City in 2013, and by 2015 actually surpasses New York City in absolute terms - although this difference is not statistically significant.

If the trend lines are extended into the near future, we would expect to find that Toronto will become significantly more dangerous than New York City for pedestrians and cyclists. As New York City was previously the most dangerous, Toronto is therefore trending to become most dangerous among the 7 cities studied.

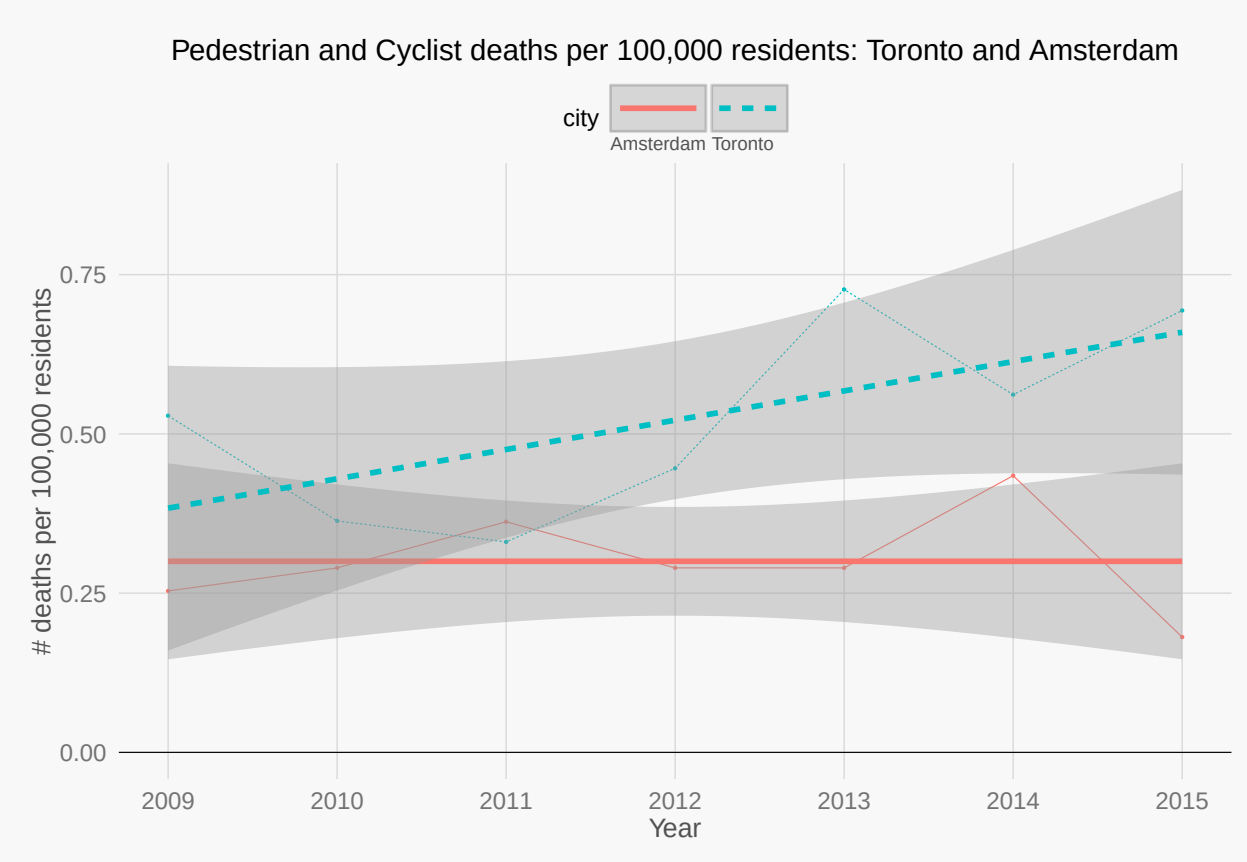
In the case of New York City, we see that Toronto begins comparatively safer but quickly catches up. Although Toronto was significantly safer in 2009, the difference between the two cities becomes non-significant by 2013, and by 2015 Toronto actually surpasses New York in absolute terms (although the difference is still not significant).

The 7-year trend for New York is negative, whereas the 7-year trend for Toronto is positive. If these trends are extended just 2 or 3 years into the future, then we would expect to find that Toronto has become significantly more dangerous than New York City.



3.3 Direct Comparison: Amsterdam and Toronto

Interestingly, in 2009 pedestrian and cyclist fatalities in Toronto were not significantly different from Amsterdam's rates. However, by 2011 Toronto did have significantly more fatalities and the gap appears to be widening. In contrast, Amsterdam appears to have a relatively constant rate of pedestrian and cyclist fatalities per capita.



4 Discussion

This analysis suggests that in 2009 Toronto was one of the safer cities in the study. However, by 2015 Toronto had risen to the highest number of pedestrian and cyclist fatalities per capita among the 7 cities studied, and is trending to become significantly more dangerous than all other cities studied.

Although this report was originally motivated by conditions in the city of Toronto, the results can be used to tell a story about each city.

5 Conclusion

- There are risks inherint in following trends
- Likewise, there are risks in ignoring them
- Toronto is on track to become more dangerous

6 References

7 Appendix

7.1 Trend lines

	intercept	slope
Amsterdam	0.2971794	0.0040929
Chicago	0.4385113	0.0043063
Copenhagen	0.2571088	0.0033455
London	0.6031259	-0.0053331
Los Angeles	0.4772473	0.0051122
New York City	0.6856390	-0.0039906
Toronto	0.4646308	0.0174627

7.2 License