Lower Income Wards Experience More Civilian Deaths from Fires *

Carly Penrose

2024-01-24

Using Toronto Fire Service data from OpenData Toronto and Toronto ward profiles, this paper found Toronto Centre is the ward in which the most civilian deaths from fires took place. There also appears to be a negative relationship between the median income of a ward and the number of civilian deaths from fires, with lower income wards having the most deaths in fires.

Introduction

In 2021, 873 were injured in a structure fire, according to Statistics Canada (2023) data. Each year, many more are displaced. While fires can be devastating for all those who experience them, news reports out of Hamilton, Ontario suggest fires don't affect all equally (Buist and Moro, 2017). Fires are more severe and more deadly in low income areas of Hamilton compared to affluent suburban areas, the author found. Research out of the United Kingdom has also found various sociodemographic factors of disadvantage (Smith, Wright, & Solanki, 2008) are linked to more destructive and deadly fires.

The Toronto Fire Service (TFS) is largest fire departments in Canada and the fifth-largest in North America (City of Toronto, 2024). It has 85 fire stations and serves a population of nearly 3 million people in the City of Toronto across 25 wards. TFS provides data about alarms in the city and the source, effects and response times.

In this paper, I will test the hypothesis that lower income areas have more dire outcomes from fires. I explore the wards in which civilian casualties from fires were the greatest using fire incident data from 2018 to December 2022 provided by the Toronto Fire Marshal and published on OpenData Toronto. I then examined the average income of each ward according to the 25 ward profiles published by the City of Toronto and plotted the two variables.

*Code and data is available at: github.com/CarlyPenrose/Toronto_Fires

Data

Data used come from the Open Data Toronto Portal through the library `opendatatoronto` (Gelfand, 2022). Data were cleaned and analyzed using the open source statistical programming language R (R Core Team, 2023). Libraries `tidyverse` (Wickham et al., 2019), `janitor` (Firke, 2023), `knitr` (Xie, 2023), `dplyr` (Wickham, 2022), and 'lubridate' (Grolemund, 2011) were used for simulating, cleaning, running tests and creating graphics for the project.

Fire Incidents data

Fire Incidents data are provided by the City of Toronto Fire Marshall and are updated on OpenData Toronto on an annual basis. The most recent data are from December 2022. The dataset tracks all fire incidents for which TFS was alerted, starting in 2011.

The dataset includes nearly 30,000 fire incidents over 11 years. It tracks the date of the incident, the location to the nearest intersection as well as the ward in which the incident took place, the time that TFS was alerted to the fire and the time that TFS arrived at the scene. It also records civilian casualties, TFS casualties, property lost (in dollars) and incident type.

Data was isolated for 2018 through 2022, because the City of Toronto switched from a 44-ward model to a 25 ward model in 2018, and ward information recorded prior to 2018 would not match more recent data.

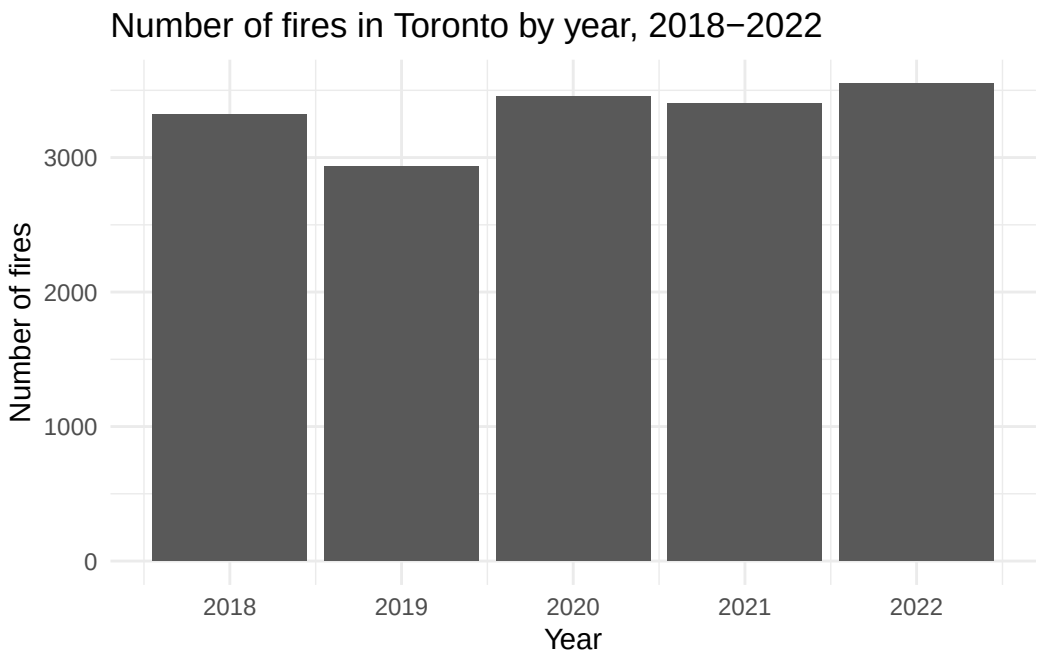
Ward demographics

The City of Toronto provides ward profiles for each of its 25 wards. This includes population, age, ethnic group, language spoken and median income. The data for median income of each ward was collected from ward profiles based on the 2021 census and compiled into a single dataset. This data was then merged with the fire dataset to allow for comparison.

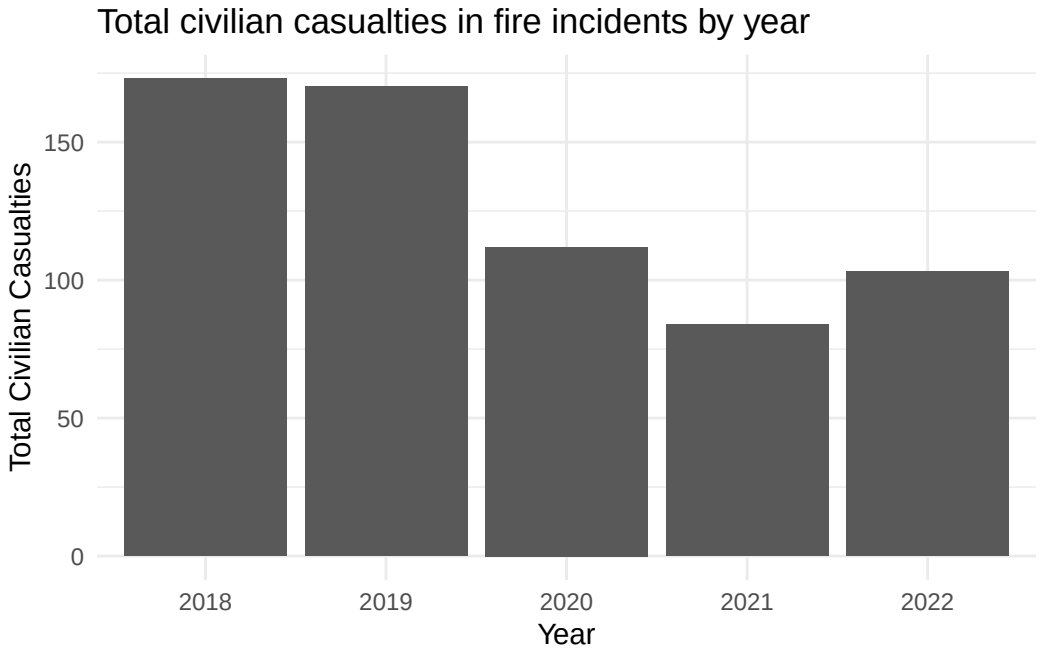
Results

Fire incidents by year

Of the years studied, the greatest number of individual fire incidents in Toronto were relatively constant. The year with the most fire incidents was in 2022, followed closely by 2020.

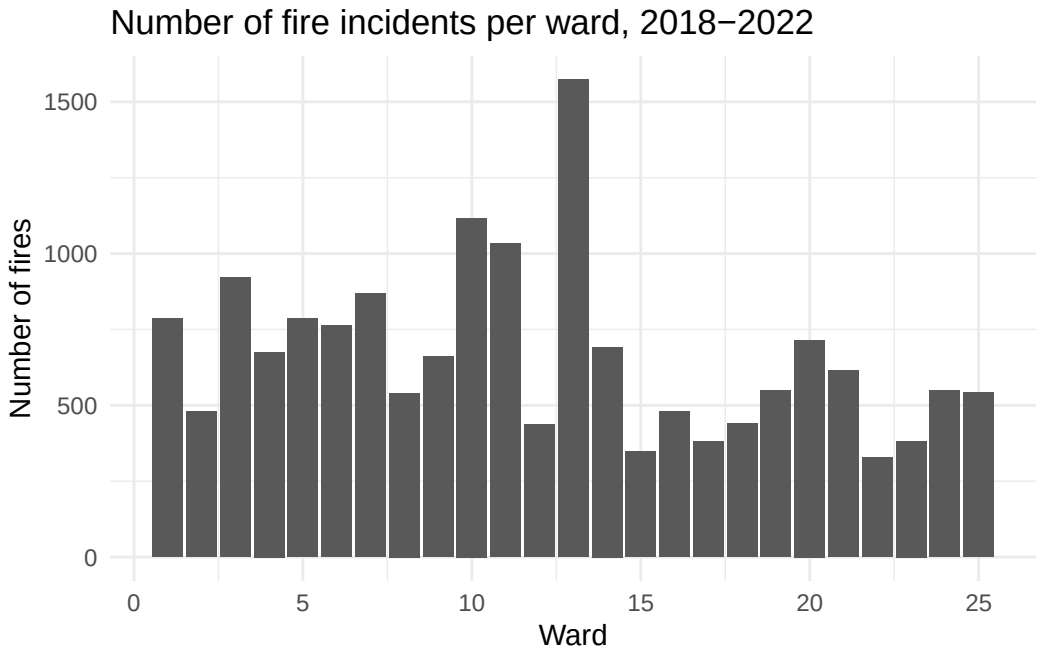


The greatest number of civilian deaths from fires in Toronto happened in 2018 followed closely by 2019.

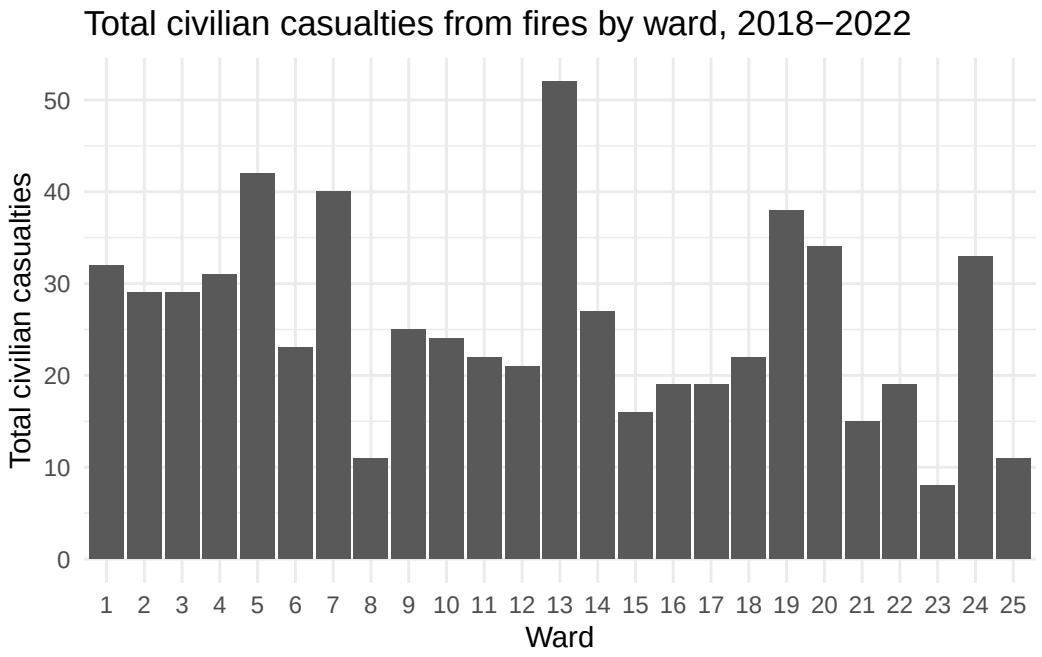


Fire incidents by ward

The ward which had the greatest number of unique fire incidents from 2018 to 2022 was ward 13, Toronto Centre, with the fewest in Scarborough North, ward 23.

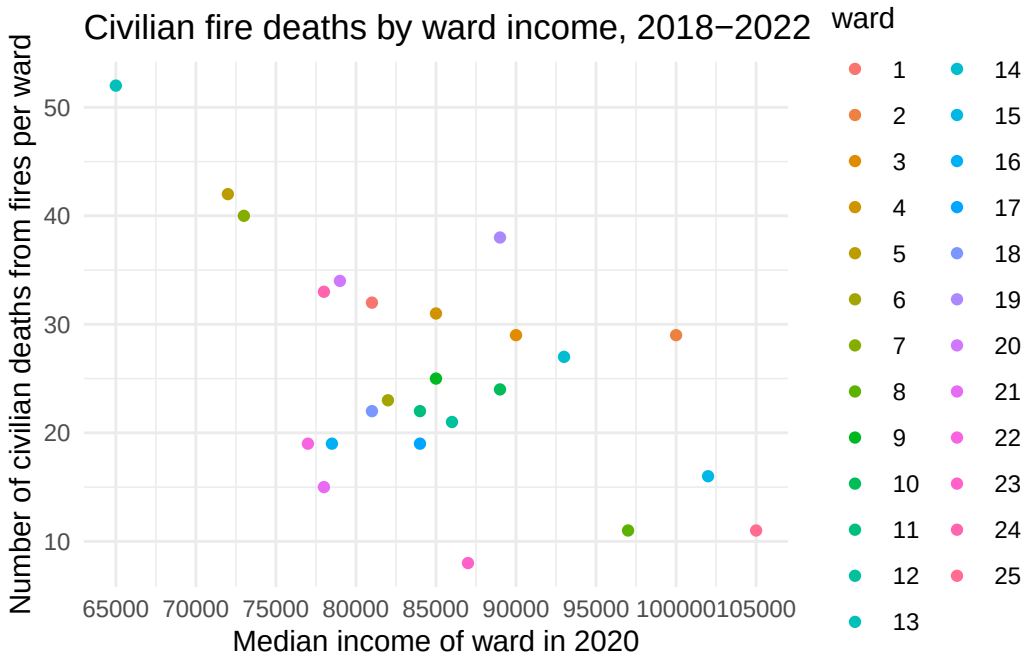


The ward in which the most civilian casualties due to fires took place was ward 13, Toronto Centre. The ward with the fewest civilian casualties due to fires was ward 23, Scarborough North.



Fire incidents relationship to income

There appeared to be a negative relationship between median income in a ward and the number of civilian casualties from fires in Toronto. The higher the median income of a ward, the fewer civilian deaths occurred in that ward.



Conclusion

This paper investigated the wards in which the most civilians died from structure fires, according to TFS data from the Toronto Fire Marshal retrieved from OpenData Toronto. Toronto Centre experienced the most civilian deaths from fires, while Scarborough North has the fewest. There appeared to be a negative reltaionship between number of civilian casualties from fires and the median income of a ward. It is possible this relationship could be explained by other factors such as density of housing units. More research should be done to clarify the nature of the relationship between income and civilian risk of death in a structure fire.

References

R Core Team. 2023. *R: A Language and Environment for Statistical Computing*. Vienna, Austria: R Foundation for Statistical Computing. https://www.R-project.org/.

Wickham, Hadley, Mara Averick, Jenny Bryan, Winston Chang, Lucy D'Agostino McGowan, Romain François, Garrett Grolemund, et al. 2019. "Welcome to the Tidyverse." *Journal of Open Source Software* 4 (43): 1686. https://doi.org/10.21105/joss.01686.

Firke, Sam. 2023. *janitor: Simple Tools for Examining and Cleaning Dirty Data*. https://CRAN.R-project.org/package=janitor.

Xie, Yihui. 2023. *knitr: A General-Purpose Package for Dynamic Report Generation in R.* https://yihui.org/knitr/.

Grolemund, Garrett, and Hadley Wickham. 2011. "Dates and Times Made Easy with lubridate." *Journal of Statistical Software* 40 (3): 1–25. https://doi.org/10.18637/jss.v040.i03.

Gelfand, Sharla. 2022. *opendatatoronto: Access the City of Toronto Open Data Portal.* https://CRAN.R-project.org/package=opendatatoronto.

Statistics Canada. 2023. Table 35-10-0195-01 Fire-related deaths and persons injured, by type of structure.https://doi.org/10.25318/3510019501-eng

Buist, S. and Moro, T. 2017. "When fire meets poverty: The economics of fire", *The Hamilton Spectator.* https://www.thespec.com/news/hamilton-region/when-fire-meets-poverty-the-economics-of-fire/article_28c2acd7-2101-5579-b9cd-82b5368a09af.html

Smith, R., Wright, M., and Solanki, A. 2008. Analysis of fire and rescue service performance and outcomes with reference to population socio-demographics. Department for Communities and Local Government, https://webarchive.nationalarchives.gov.uk/ukgwa/20120919141831/http://www.communities.gov.uk/publications/fire/frsperformanceanalysis

City of Toronto. Fire Services. https://www.toronto.ca/city-government/accountability-operations-customer-service/city-administration/staff-directory-divisions-and-customer-service/fire-services/

OpenData Toronto. 2024. Fire Incidents. https://open.toronto.ca/dataset/fire-incidents/

OpenData Toronto. 2024. Ward Profiles (25-Ward Model). https://open.toronto.ca/dataset/ward-profiles-25-ward-model/