No Correlation Between Gun Control Legislation and Amount of Shootings in Toronto, Ontario*

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Data from the Toronto Police Service was used to analyze year-to-year trends on shootings within the city alongside the passage of gun access legislation. Based on the observed trends, there is no significant correlation between passing or reversing gun control legislation on the number of shootings in Toronto. Analysis of Toronto corroberates similar studies based on gun access legislation in the United States, indicating a broader pattern of gun access legislation being unrelated to total shooting deaths/injuries.

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*Code, data, and .QMD available at: https://github.com/rluchin/No-Correlation-Between-Gun-Control-and-Shootings. All code and analysis done with R programming language (R Core Team, 2023). Credit to Luca Carnegie for the code template for this footer.

Introduction

Gun violence is an epidemic affecting the vast majority of North American cities (Gramlich 2023). The most common piece of legislation we see debated in government is that of firearms access; this debate has become incredibly divisive and leads to a sharp divide in policy-making between party lines. However, there is a debatable degree of impact that this type of legislation has, as a whole, on total shooting trends in major cities.

This paper visualizes and observes total shooting trends in Toronto alongside the passage of major firearms access policies, both restrictive and non-restrictive policies, using the R programming language (R Core Team 2023). The purpose of doing this is to observe whether firearms access legislation has a direct impact on shooting trends within Toronto, a city which has observed a steady increase in shootings in the face of varying gun-control policies being written into law.

Findings indicate that there is limited, if any, correlation between firearms access legislation and overall shooting trends. There is no data to indicate that increasing access to firearms will lead to more shootings, and the restricting access leads to less. As this is the common divide in politics on the issue, it is important to observe this data to promote informed policy making in government. Public safety is an essential issue for any government, but policy that disproportionatly affects indigenous communities (Deer 2022) must be studied for effectiveness, rather than passed quickly for a quick win.

Data

2.1 Raw Data

Raw data was acquired through Open Data Toronto (Gelfand 2022). The specific data set acquired was the official Toronto Police Service tracker of all daily shootings from 2004 to the end of 2023. This data set is extensive, cataloging every firearm discharge within city limits alongside Case ID and amount of injuries and/or deaths associated with the event. One thing of note is, prior to 2008, the tracker only contains the data for illegal firearm discharges within city limits, as Toronto didn't pass the bylaw against discharging firearms until 2008 (Puryear 2008). Furthermore, the uncleaned dataset includes specific elements of each individual shooting; such as hour the shooting took place and within what ward. These variables are irrelevant to us as we are focused on the greater year-to-year trends of shootings within the city. What we focus on are columns 4 and 5, or "OCC_YEAR" and "OCC_MONTH" respectively.

2.2 Cleaned Data

All irrelevant fields were eliminated from the cleaned file. This included eliminating all irrelevant columns folding the relevant columns into a single variable. The cleaned data set ignores discharges with no injuries or deaths, and folds the "Deaths" and "Injuries" variables into a single one labelled "Shootings". Furthermore, we have no need to organize the data by day of week, so the daily shootings were further summarized to organized by month of the year. The new numbers were checked to be accurate by comparing the generated variables with the official Toronto Police numbers for daily shooting injuries and deaths (Services 2024).

`Table of First 6 Rows from Cleaned Data`

Year	Month	Shootings
2004	Apr	12
2004	Aug	10
2004	Dec	9
2004	Feb	2
2004	Jan	12
2004	Jul	8

2.3 Methodology

Graphs for depicting year-to-year or month-to-month trends are used visualize shooting data alongside relevant legislation concerning legal firearm access. This is achieved by graphing specific dates (years/months), between 2007 and 2022, wherein significant firearm access ("gun control") legislation was passed. This range was chosen to keep the data from getting cluttered while also giving sufficient room to analyze year-over-year trends at any point in the data. Legislation reviewed includes policy which increase legal firearm access ("reducing gun control") and legislation which reduces legal firearm access ("increasing gun control"). For relevant years, total shooting trends will be analyzed by comparing when the legislation was received royal ascent (became law) and what happened in the short-term and long-term following the enactment of said legislation.

Results

3.1 Shootings by Years With Major Gun Control Passing

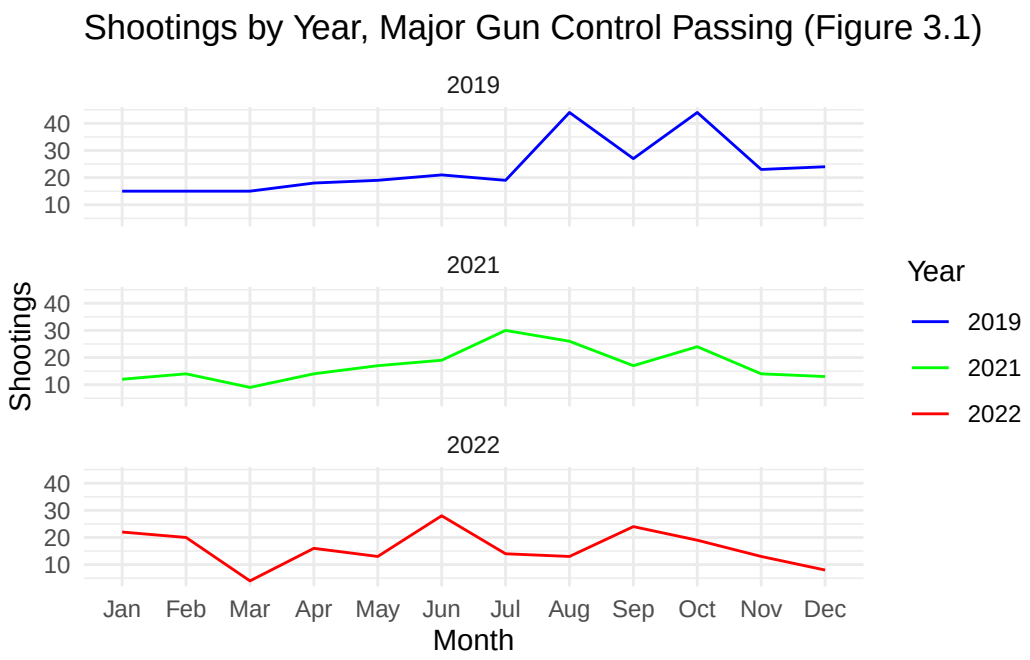


Figure 3.1 shows shootings by month in recent years where major gun control received ascent. This includes 2019, 2021, and 2022; where Bill C-71 (Public Safety and Emergency Preparedness 2019), the AR-15 prohibition (G. of Canada 2020), and the handgun transfer freeze (P. S. Canada 2022), were enacted (or saw effect) respectively. What we find is there is no significant change in trends following the enactment of said legislation. For example, Bill C-71 received ascent in June, 2019, and what we see is a huge spike in shootings following the summer months. However, this trend is consistent across all 3 of these graphed years, indicating the spike is unrelated to the passing of said legislation. Furthermore, in 2021, the first full year following the AR-15 prohibition in May 2020 we see similar trends to 2019. Notably, shootings for 2021 are lower, however this is also during a period of varying COVID-19 restrictions (LLP 2022), therefore the correlation with gun control isn't definitive. Finally, we observe 2022, where the handgun transfer freeze was enacted in October 2022. We see an immediate decline going into November of that year, but this is consistent with the trends in both 2021 and 2019. This continues the observed pattern of gun control legislation having no notable affect on amount of shootings.

3.2 Total Shootings, Year-Over-Year, 2007-2022

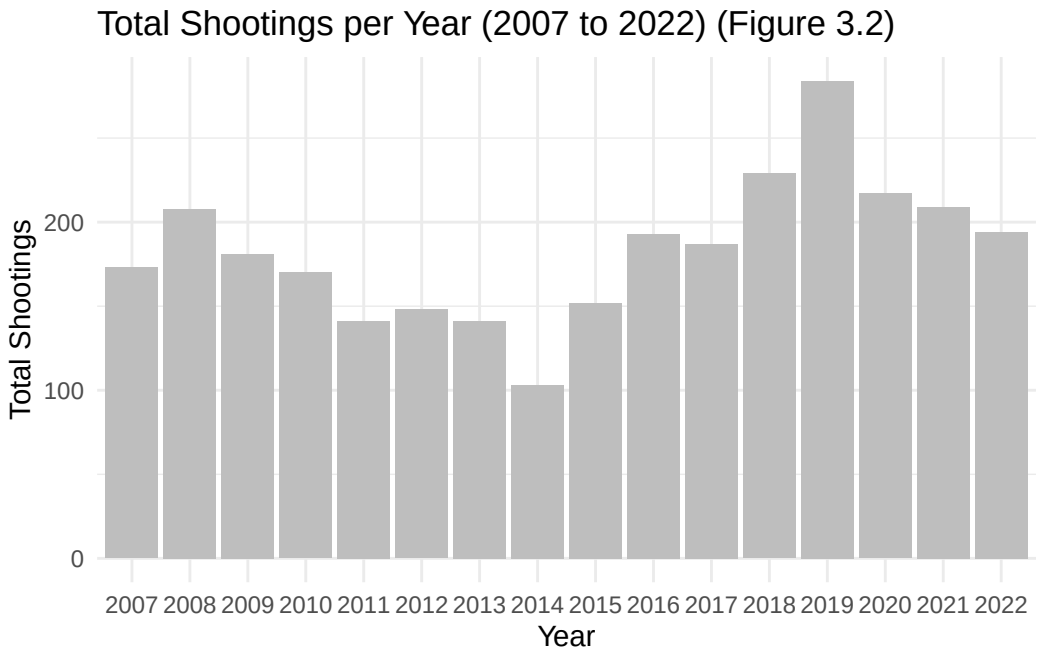


Figure 3.2 visualizes the full year-over-year shooting trends in the city of Toronto from 2006 to 2023. There are a couple periods of note before we break down the data here. The first is 2006-2015: this is the period of the previous ruling Conservative party of Canada, which held a pro-gun ownership ideology. The second period is from 2016-2023: this is the current tenure of the ruling Liberal party, which holds a pro-gun control ideology.

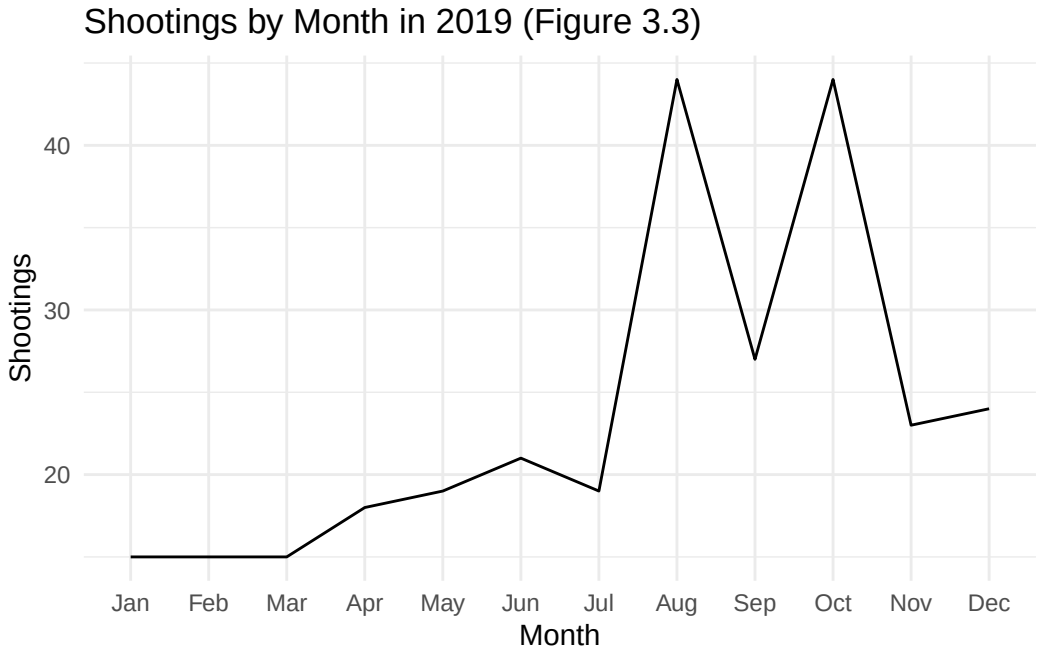
With this in mind, we can break down specific trends related to passing of relevant legislation. Working from 2006 onward, we see the first major piece of pro-ownership policy receive ascent in 2012, where the "Long Gun Registry", or a registry of all firearms classified as "Non-Restricted" in the Canadian legal code, was decommissioned and its data destroyed (P. S. Canada 2011). From 2012, we see an unsubstantial decline in shootings in 2013 followed by a drastic decline in 2014. We can extrapolate this data to imply that the long-gun registry, and its destruction, had no real effect on reducing or increasing the amount of shootings in Toronto. This is due to there being no sharp impact on total shootings immediately following the destruction of said registry, which was a legislative move akin to destroying conviction history (REF). Meaning, if the registry had an effect on reducing shootings, then a sharp increase would be expected upon its destruction. Rather, we saw no immediate effect in either direction.

Moving to analyze the Liberal tenure, we see an almost immediate increase in shootings overall in Toronto. While sensationalists may look at this trend and point to it being due to "crim-

inalizing legal gun owners and taking away the right to self defence" (Firearm Rights 2022), this trend actually follows a steady increase in shootings from 2014 onward. The first major piece of firearms legislation we see under the Liberal tenure is in 2019, with the ascent of C-71 (Public Safety and Emergency Preparedness 2019). This year is the most violent in recent memory for Toronto, seeing upwards of 250 shootings for that year. Looking at 2019 alone, this could indicate that restricting legal access leads to an increase in gun crime. However, we see a gradual decline in shootings following 2019 and continuing into 2023. While the gradual passing of gun control in these years (P. S. Canada 2022) could potential be attributed to the decline, it is dishonest to ignore the circumstances in 2020-2022 where regular COVID restrictions affected public and private gatherings (LLP 2022).

By looking at nearly 2 decades of shooting trends, we start to see that restricting (or de-restricting) legal firearms access seems to have no correlation with how many shootings are committed year to year.

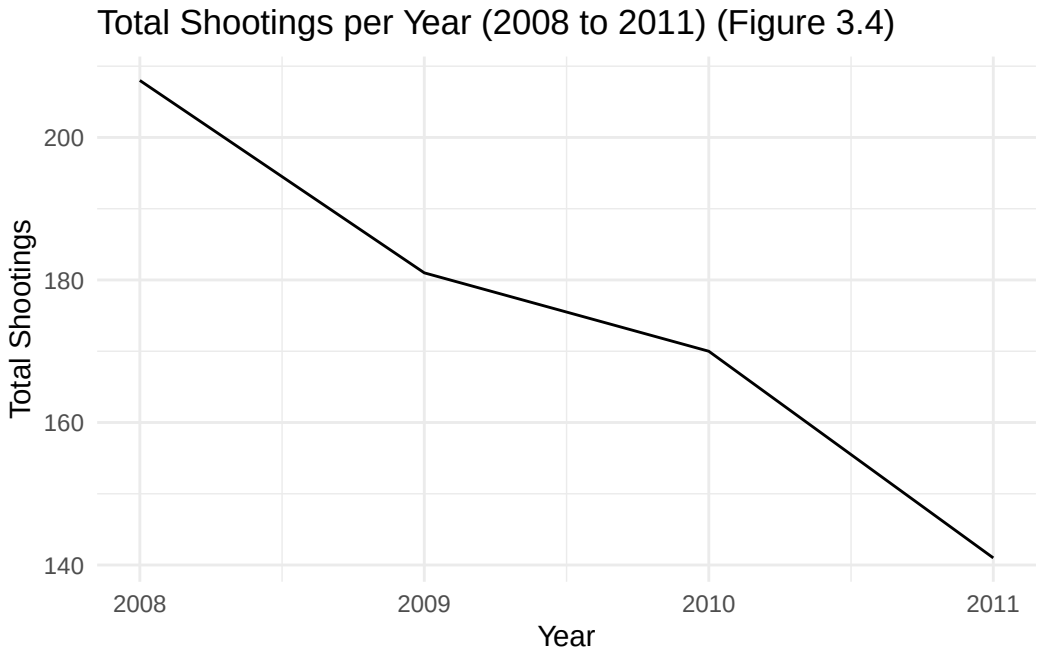
3.3 Shootings By Month, 2019



2019 saw a record number of shooting deaths and injuries in the city of Toronto. This spike occured alongide the passage of the most substantial gun control policies at the time (Public Safety and Emergency Preparedness 2019). In Figure 3.3, we see the overall shooting trends remain consistent with what we see year-to-year in the city of Toronto (Figure 3.1). However, there is a more dramatic spike between July and August than is to be expected: a 200%~ increase as opposed to a 100%~ rise (Figure 3.1, Figure 3.5). This would indicate a positive

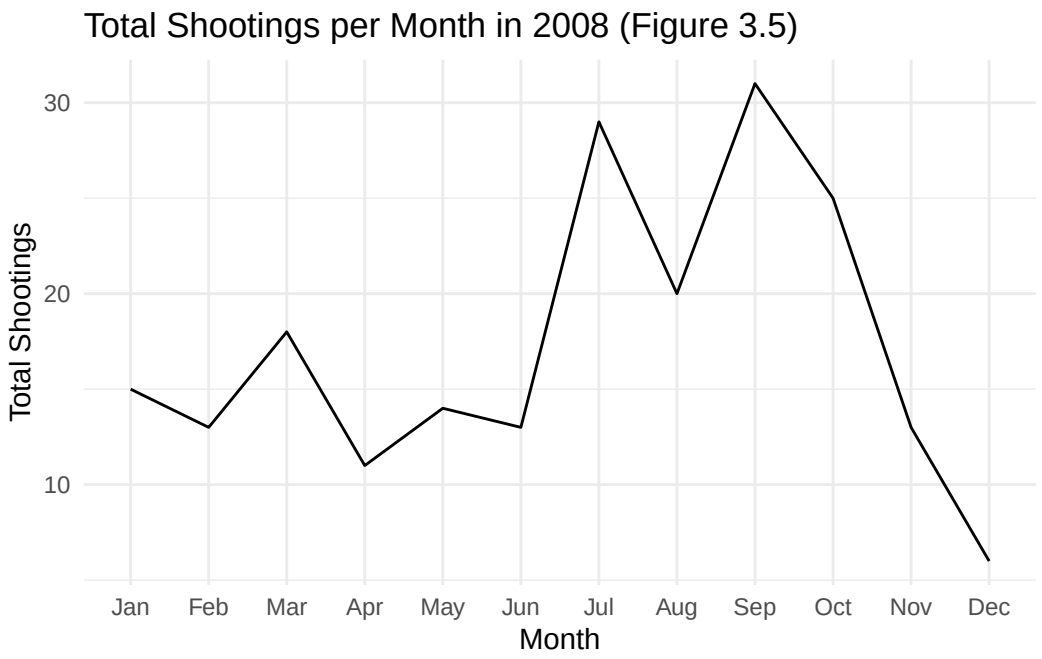
correlation between passing gun control and a rise in city-wide shootings, but as this is the only instance of a gun-control-passing/rise-in-shootings correlation its more likely that there is an aggravating factor, unrelated to gun control, which is leading to a rise in shootings. We continue to observe a pattern of firearm access legislation having no correlation with total shootings.

3.4 Shootings per Year, 2008 to 2011



In 2008, Toronto passed a major piece of municipal legislation which banned the discharge of firearms within city limits (Puryear 2008). If we are to look at the year-over-year following 2008 alone, it would be reasonable to assume that there is a direct correlation between the passage of this legislation and a decline in shootings. This would be the first concrete instance of gun control reducing total shootings so far in this analysis. However, the year over year doesn't give the full picture.

In Figure 3.5, we see a graph of the monthly shootings in 2008. The legislation was proposed in May, 2008 and was officially adopted as a by-law in June of the same year. When observing the monthly shootings, we see no change in observed trends, other than a relatively high spike in the summer shootings volume when compared to Figure 3.1. This indicates that the year-to-year decrease from 2008 in shootings was due to factors unrelated to the passage of gun control. We continue to observe limited correlation between firearm access legislation and reduction/increase in shootings.



Conclusion

From the limited sample size of Toronto alone, we observe there to be no definitive correlation between firearms access laws and total shootings in Toronto. There is no correlation to be found between the passage of gun control and the decrease of shootings, and the loosening of gun control and an increase in shootings. For every potential correlation (Figure 3.4, Figure 3.2), scrutinizing the data leads to the potential correlation becoming limited at best (Figure 3.5), and unrelated at the worst (Figure 3.2, 2020-2022).

Effective legislation begins at understanding the issue. Toronto continues to see generally low rate of decline in shootings (Figure 3.2), despite regular legislative actions which target firearm access. All levels of government seem to tout the same policies without analyzing the effectiveness (or ineffectiveness) of their firearm access policies, resulting in shootings being unaffected while law-abiding groups of Canadians become disproportionately affected by policy change (Deer 2022).

Based on the data analyzed here, it would be in the government's best interest to understand what causes a spike in gun crime, and how to mitigate it without the disproportionate "punishment" of Canadians who rely on firearms for sustenance or sport (Deer 2022). This paper corroborates the findings of (Research 2023) and (Polsby 1996), among others who have studied the effects of firearms access legislation and found no correlation with gun violence.

Special thanks to the tidyverse (Wickham et al. 2019), dplyr (Wickham et al. 2023), lubridate (Grolemund and Wickham 2011), janitor (Firke 2023), knitr (Xie 2023), and R (R Core Team 2023) teams for making this analysis possible.

References

Canada, Government of. 2020. "Regulations Amending the Regulations Prescribing Certain Firearms and Other Weapons, Components and Parts of Weapons, Accessories, Cartridge Magazines, Ammunition and Projectiles as Prohibited, Restricted or Non-Restricted: SOR/2020-96." *Canada Gazette* 154 (3). https://doi.org/10.21105/joss.01686.

Canada, Public Safety. 2011. "Abolishing the Long-Gun Registry: Proposed Reforms to the Firearms Act and Criminal Code." https://www.publicsafety.gc.ca/cnt/nws/nws-rlss/2011/20111025-2-en.aspx.

———. 2022. "Bill c-21 and a National Freeze on Handguns." https://www.publicsafety.gc.ca/cnt/cntrng-crm/frrms/c21-en.aspx.

Deer, Ka'nhehsí:io. 2022. "AFN Passes Emergency Resolution to Oppose Federal Gun Control Legislation." https://www.cbc.ca/news/indigenous/afn-resolution-gun-control-legislation-1.6679444.

Firearm Rights, Canadian Coalition for. 2022. "Our Vision - CCFR." https://firearmrights.ca/mission-and-values/.

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

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

Gramlich, John. 2023. "What the Data Says about Gun Deaths in the u.s." https://pewrsr.ch/448q4hU.

Grolemund, Garrett, and Hadley Wickham. 2011. "Dates and Times Made Easy with Lubridate." *Journal of Statistical Software* 40 (3): 1–25. https://www.jstatsoft.org/v40/i03/.

LLP, Stikeman Elliot. 2022. "Ontario's COVID-19 Response: A History of Announced Measures, 2020-2022." https://www.stikeman.com/en-ca/kh/corporations-commercial-law/ontarios-economic-reopening--history-of-announced-measures.

Polsby, D D. 1996. "Gun Control Does Not Prevent Violence." *From Violence: Opposing Viewpoints*, 267–73. https://doi.org/NCJ-159343.

Public Safety, Minister of, and Canadian Parliament Emergency Preparedness. 2019. "C-71 - an Act to Amend Certain Acts and Regulations in Relation to Firearms." https://www.parl.ca/legisinfo/en/bill/42-1/C-71.

Puryear, Eric. 2008. "Toronto City Council Passes Bans on Gun Education, Shooting Ranges, and Gun Manufacturing." https://www.learnaboutguns.com/2008/06/25/toronto-city-council-passes-bans-on-gun-education-shooting-ranges-and-gun-manufacturing/.

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

Research, RAND Policy. 2023. "Gun Policy Research Review." https://www.rand.org/research/gun-policy/analysis.html.

Services, Toronto Police. 2024. "TPS Crime Statistics - Shootings & Firearm Discharges." https://data.torontopolice.on.ca/pages/shootings.

Wickham, Hadley, Mara Averick, Jennifer 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.

Wickham, Hadley, Romain François, Lionel Henry, Kirill Müller, and Davis Vaughan. 2023. *Dplyr: A Grammar of Data Manipulation*. https://CRAN.R-project.org/package=dplyr.

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