Article

Firearm-purchase laws that limit the number of guns on the market reduce gun homicides in the South Side of Chicago

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SUMMARY

Gun violence and homicide have been pressing issues in the South Side of Chicago for decades, yet little research exists on the relationship between the passage of firearm-purchase laws by the United States Congress and gun homicide rates in the South Side. Firearm-purchase laws define (and usually tighten) the process to buy guns. Our study analyzes firearm-purchase laws passed by Congress between 1993 and 2018 to determine their success in reducing gun homicides in the South Side of Chicago. The hypothesis of this study is that firearm-purchase laws decrease gun homicides in the South Side. We used an interval-analysis method to determine eight firearm-purchase laws' effectiveness in decreasing gun homicides. The results show that during the first six intervals, when the first five firearm-purchase laws were passed, gun homicides decreased in the South Side. However, gun homicides increased in the next three intervals, with the passages of the next three firearm-purchase laws. Additionally, the passage of firearm-purchase laws that merely extended previous firearm-purchase laws were found to result in higher gun murder rates, suggesting that such laws were ineffective and actually counterproductive.

INTRODUCTION

The South Side of Chicago is a collection of Chicago neighborhoods that can be defined as community areas 34-43, 60, and 69 (**Figure 1**) (1). Both gun homicides and firearm-purchase laws affect several parties in the South Side, including residents, politicians, gun manufacturers and organizations, and law-abiding gun owners. Therefore, it is imperative to determine whether firearm-purchase laws by Congress after 1993 were successful in decreasing gun homicides in the South Side to guide future legislative efforts combating the epidemic of gun violence in Chicago.

The sweeping Brady Act was passed by Congress in 1993 to prevent potential criminals from possessing guns (2). The Brady Act enhances existing firearm-purchase laws by introducing background checks and making gun permits harder to obtain by adding a five-day waiting period following the purchase of a gun (2). Seven more laws passed by Congress between 1993-2018 were deemed firearm-purchase laws because they affected the firearm-purchase process (3). The laws' summaries, taken from the Library of

Congress website, are summarized below.

The Violent Crime Control and Law Enforcement Act of 1994 prohibited the manufacture, transfer, or possession of a semiautomatic assault weapon (SAW) and required fingerprints to be given when purchasing a firearm. The Crime Identification Technology Act of 1998 provided grants to each state to update the criminal background check process to increase its efficiency. It upgraded criminal history and criminal justice record systems, improved criminal justice identification, and promoted compatibility and integration of national, state, and local systems for criminal justice purposes. The reauthorization of the ban on undetectable firearms in 2003 made it illegal to manufacture, import, possess, or transfer a firearm that is not detectable by walk-through metal detectors or airport x-ray machines. The Protection of the Lawful Commerce in Arms Act of 2005 preserved a citizen's access to a supply of firearms and ammunition for all
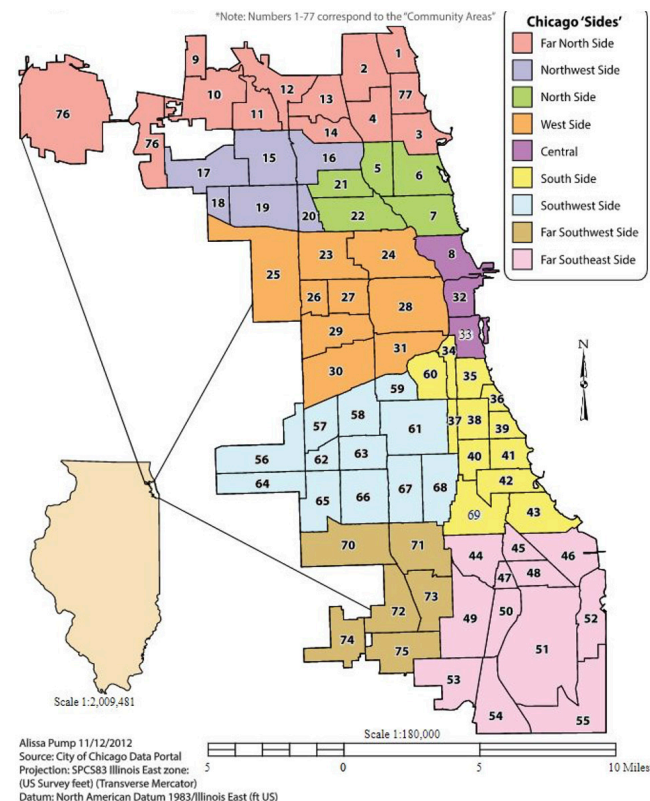

Figure 1. City of Chicago Community Area and 'Sides'. The South Side is community areas 34-43, along with 60 and 69.

Passage Date	Law	Code
11/30/1993	Brady Handgun Violence Prevention Act	H.R.1025
9/13/1994	Violent Crime Control and Law Enforcement Act	H.R.3355
10/9/1998	Crime Identification Technology Act	S.2022
12/9/2003	To reauthorize the ban on undetectable firearms	H.R.3348
10/26/2005	Protection of Lawful Commerce in Arms Act	S.397
1/8/2008	NICS Improvement Amendment Act	H.R.2640
12/9/2013	To Extend the Undetectable Firearms Act of 1988 for 10 years	H.R.3626
2/28/2017	Extends NICS Improvement Amendment Act	H.J.Res.40

Table 1. Summary of each of the 8 collected firearm-purchase laws. Passage date, name, and code used to identify it in the US Congress laws database are provided (5).

Interval #	Q1 Start	Q2 start	Q3 Start	Q4 start	End	Laws in effect
One	1/1/1991	10/1/1991	7/1/1992	4/1/1993	12/31/1993	None
Two	1/1/1994	4/1/1994	6/1/1994	8/1/1994	9/30/1994	B
Three	10/1/1994	11/1/1995	11/1/1996	11/1/1997	10/31/1998	B, V
Four	11/1/1998	3/1/2000	6/1/2001	10/1/2002	12/31/2003	B, V, C
Five	1/1/2004	7/1/2004	12/1/2004	6/1/2005	10/31/2005	B, V, C, R
Six	11/1/2005	6/1/2006	1/1/2007	8/1/2007	1/31/2008	B, V, C, R, P
Seven	2/1/2008	8/1/2009	2/1/2011	8/1/2012	12/31/2013	B, V, C, R, P, N
Eight	1/1/2014	11/1/2014	8/1/2015	6/1/2016	2/28/2017	B, V, C, R, P, N, E
Nine	3/1/2017	9/1/2017	2/1/2018	8/1/2018	12/31/2018	B, V, C, R, P, N, E, EN

Table 2. Summary of the intervals used in this study. The laws in effect are abbreviated as follows: B = Brady Act, C = Crime Identification Technology Act, E = To Extend the Undetectable Firearms Act of 1988 for 10 years, EN = Extends NICS Improvement Amendment Act, N = NICS Improvement Amendment Act, P = Protection of Lawful Commerce in Arms Act, R = To reauthorize the ban on undetectable firearms, V = Violent Crime Control and Law Enforcement Act.

lawful purposes, including hunting, self-defense, collecting, and competitive or recreational shooting. This act was the only firearm-purchase law which did not tighten the firearm-purchase process. The NICS (National Instant Criminal Background Check System) Improvement Amendment Act of 2008 amended the Brady Act to update, correct, modify, or remove obsolete records from the background check system to increase its efficiency. In 2013, the previously mentioned ban on undetectable firearms was extended for another ten years. Similarly, in 2017, the NICS Improvement Act was extended for another 10 years as well. These firearm-purchase laws are summarized in **Table 1**. It should be noted that the earlier laws regulated the purchase of firearms more strongly than the later laws (for example, some of the later firearm-purchase laws were just extensions of already existing firearm-purchase laws).

Firearm-purchase laws are very controversial, and there are two conflicting perspectives in the gun control debate: those for tighter gun-control and those for looser gun-control. Tighter gun-control advocates believe that introducing more firearm-purchase laws would lead to a decrease in gun homicides, while looser-gun control advocates believe that introducing more firearm-purchase laws would lead to an

increase in gun homicides.

There are several research studies similar to this one whose conclusions were used to formulate the hypothesis of this study. One example is the research conducted by Michael Siegel and Claire Boine from the Boston University School of Public Health. The researchers conducted a study in which the success of every state firearm-purchase law was measured against their respective gun crime rates (4). Their goal was to identify which types of firearm-purchase laws were most effective in decreasing gun crime. They concluded that universal background checks, prohibition of firearm possession by people with a history of any violent misdemeanor, and extreme risk protection laws that could seize firearms from an individual who is perceived as a threat, were the most successful in decreasing gun crime at the state level (4).

Criminologist Franklin Zimring's research also supports the hypothesis through the use of gun homicide statistics and more gun-policy analysis (5). Zimring tested the effectiveness of several types of firearm-purchase laws and concluded that reducing the supply of handguns through supply-reduction laws and requiring further licensing to sell handguns would stop the illegal transfer of guns and lower gun homicides (5).
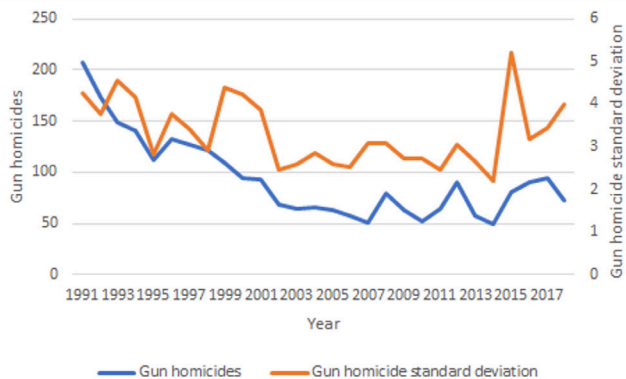
Figure 2. Annual South Side gun homicides and standard deviations 1991-2018. Gun homicides decreased from their 1991 levels, but recently rose in 2016.

Figure 3. Annual South Side property crimes and standard deviations 1991-2018. Property crimes decreased from their 1991 levels. The standard deviation year-to-year also mostly decreased.

Figure 4. Annual city of Chicago gun homicides and standard deviations 1991-2018. Gun homicides decreased from their 1991 levels, but spiked in 2016. The standard deviation year-to-year did not follow a trend and widely fluctuated.
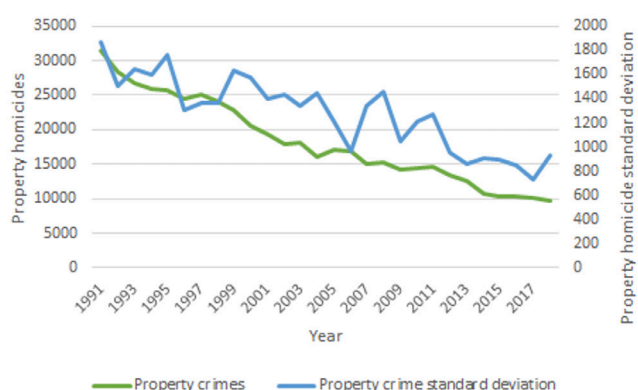

Figure 5. Annual city of Chicago property crimes and standard deviations 1991-2018. Property crimes decreased from their 1991 levels. The standard deviation year-to-year mostly decreased.

In another study, the Chicago Police Department investigated the source of guns used to commit crimes (6). It was found that 60% of these crime guns were purchased outside of Illinois in states such as Indiana, Wisconsin, and Mississippi, which have looser firearm-purchase restrictions. Therefore, the report claimed that tightening the firearm-purchase process federally would prevent guns from easily being bought in neighboring states and used illegally in Chicago (6).

The common theme of these research papers is that tighter federal firearm-purchase legislation would result in fewer guns on the market, prevent dangerous people from accessing these guns, and would therefore lower gun homicides. These studies led us to the hypothesis that the introduction of firearm-purchase laws by Congress after the Brady Act were successful in decreasing gun homicide rates in the South Side.

RESULTS

We used crime data reported from the South Side following the intervals as outlined in **Table 2**. A preliminary analysis of the collected crime data revealed a general decrease in gun homicides and property crime between 1991-2018 in both the South Side and the city of Chicago. Gun homicides in the South Side fell by about 65% between 1991-2018 (**Figure 2**), while property crime fell by about 69% (**Figure 3**). In comparison, gun homicides in the city of Chicago fell by about 47% (**Figure 4**), while property crime fell by about 62% (**Figure 5**). The decreases in property crime support that crime generally declined during the timespan of this study, regardless of the firearm-purchase law passages. Therefore, a decrease in gun homicides during an interval would not be enough to classify it as a success. Instead, an interval's success would be defined relatively, compared to the other intervals within the same time span.

There were a total of 2,624 gun homicides in the South Side between 1991-2018, with an average of 7.810 gun homicides per month. We saw that there was a significant decrease in gun homicides with the passage of subsequent firearm laws (p = 0.021, two-tailed t-test). There was an average of 46.318 gun homicides per month in the city of Chicago (p = 0.005, two-tailed t-test). Therefore, according to the calculated p-values in both the South Side and city of Chicago, the relationship between the length of each interval and the total number of gun homicides during that interval was statistically significant. This is important to note because

Interval #	Average monthly South Side gun homicides during the interval	Best quarter in the interval (in the South Side)	% of total Chicago homicides	% change in average monthly South Side gun homicides from the previous interval
One	14.722	4	20.711	NA
Two	12.556	1	19.416	-11.982
Three	10.184	1	16.529	-21.408
Four	7.258	4	15.443	-28.731
Five	5.409	2	18.949	-25.475
Six	4.630	2	15.664	-14.402
Seven	5.648	2	16.687	21.987
Eight	6.132	1	13.910	8.569
Nine	7.000	3	15.635	14.155

Table 3. Significant differences in States analyzed with Tukey post-hoc. The states in the table have statistically different CO levels. For example, Arizona and Alabama have statistically different levels, the combinations of states not included were not significant.

it means that the two variables (the length of each interval and the total number of gun homicides during that interval) are strongly related. This will help when judging the laws' effectiveness in decreasing gun homicides in the South Side.

In general, the later intervals performed better in terms of reducing gun homicides and property crime in both the South Side and the city of Chicago. Interval One, which ran from January 1991 to December 1993 with no firearm-purchase laws of this study in effect, performed the worst in terms of reducing gun crime in the South Side compared to the other intervals, having the highest average monthly South Side gun homicides of 14.722 compared to the other intervals. South Side gun homicides also made up 20.711% of total Chicago homicides in Interval 1, the highest percentage compared to the other intervals.

Between Intervals One to Six, however, gun homicides progressively decreased with the conclusion of each interval. In every interval in this time period running from January 1991 to February 2008 in which five firearm-purchase laws were passed, the percentage change in average monthly South Side gun homicides from the previous interval was negative -- gun homicides consistently decreased from interval to interval. In fact, gun homicides decreased by a total of 101.998% during this time period. Intervals Five and Six arguably performed the best out of all of the intervals, having average monthly South Side gun homicides of 5.409 and 4.630 (the lowest of any interval) respectively.

This trend of decreasing gun homicides ended with the beginning of Interval Seven, however. In every interval after Interval Seven, the time period running from February 2008 to December 2018 in which extensions or amendments of previous acts were passed, the percentage change in average monthly South Side gun homicides from the previous interval was positive -- gun homicides consistently increased from interval to interval. In contrast to the large decrease in gun homicides between Intervals One and Six, gun homicides increased by a total of 44.711% in the South Side between Interval Sevens and Nine.

DISCUSSION

The hypothesis that firearm-purchase laws were an effective solution to decreasing gun homicides is valid, until Interval Seven, with the passages of the Brady, Violent Crime Control, Crime Identification Technology, Reauthorization of the ban on undetectable firearms, and the Protection of Lawful Commerce in Arms acts. The three acts passed after Interval Seven (the NICS Improvement Amendment Act, the Extension of the Undetectable Firearms Act, and the extension of the NICS Improvement Amendment Act) were extensions or amendments of previous acts. Therefore, the findings of this study suggest that such amendments and extensions are ineffective in decreasing gun homicides. It is also worth noting that the increases in gun homicides began in Interval Seven, immediately after the passage of the Protection of Lawful Commerce in Arms Act in Interval Six. As a reminder, this was the only act not to tighten the firearm-purchase process, and the results suggest that the passage of this act was followed by increases in gun homicides.

Another important finding of this study is when the peak of interval was (**Table 3**). Of the nine total intervals, only one of the intervals was most successful during quarter 3 (Interval Nine), and only two were most successful during quarter 4

(Intervals One and Four). The other six intervals were most successful during quarters 1 and 2. This means that most laws did well in terms of reducing gun crime in the beginning of their interval, but this effect weakened throughout the course of the interval.

A limitation of this study is the fact that several loopholes exist to bypass the federal firearm-purchase process. Guns are readily available in Chicago through "informal channels," and many feel that they need to carry guns for protection in the South Side's worst, crime-ridden neighborhoods (7).

Another limitation of this method is that not all of the intervals (and, therefore, quarters) were equal in length, since the firearm-purchase laws were not always passed every fixed certain number of years. However, this was the only option to measure firearm-purchase laws as a group since a new interval could only be started when a new firearm-purchase law was passed. It is impractical to use an interval-analysis method to measure the firearm-purchase laws if the time intervals are created based on the year and not based on the passage of firearm-purchase laws themselves. Another limitation is the lack of crime data available before 1991. Crime data from before the beginning of this study could provide added context to the findings. However, according to Professor Skogan, the Chicago Police Department's crime records were disorganized and not very thorough before they were digitized in the 1990s. Therefore, detailed crime records before this time are inaccessible to researchers.

Firearm-purchase laws are just one of the factors relating to gun homicides; socioeconomic conditions, policing, drugs, gangs, culture, and crime reporting could arguably also motivate crime (8). Future studies can use this study as a template to explore these other factors and gauge their effect on gun homicide not only in the South Side, but in the neighborhoods of other cities across the United States.

MATERIALS AND METHODS

In this research study, the firearm-purchase laws passed by the United States Congress after 1993 serve as the independent variable. These laws were collected from the Library of Congress (3). A filtered search on the database displayed all of the laws passed by Congress after 1993 that contained the keyword "firearm." Then, we determined whether each law regulated the purchase of firearms. If the law was a firearm-purchase law, then it was organized by year passed on a spreadsheet.

The effectiveness of the collected firearm-purchase laws was measured against monthly gun homicide rates in the South Side between January 1991 and December 2018, with monthly South Side property crime rates acting as a control. In a property crime, a victim's property is stolen or destroyed, without the use or threat of force against the victim. Property crimes include burglary and theft as well as vandalism and arson (9). Monthly Chicago gun homicide and property crime rates during the same time period were also collected to provide context to the South Side crime data.

The South Side and Chicago crime data were collected from the Chicago Police Department's CLEAR database, which contains monthly Chicago crime rates from 1991 to 2018 that can be filtered by date, type of crime, and location (10). Authorization to use the CLEAR database was provided by Professor Emeritus Wesley Skogan of Northwestern University, who initially processed and selected the data. Once accessible, the data were filtered by type of crime to display monthly Chicago gun homicides and property crime. This Chicago crime data was added to a spreadsheet for later analysis, organized by date and type of crime. Then, the data were further filtered by location to show gun homicides and property crime data in community areas 34-43, 60, and 69, which encompass the South Side. This South Side crime data were added to a separate spreadsheet for later analysis and were also organized by date and type of crime.

Each time interval started in the month following the passage of a firearm-purchase law and ended in the month when a new firearm-purchase law was passed. For example, if a firearm-purchase law was passed on 1/17/1993, the interval would begin on 2/1/1993. If the next firearm-purchase law was passed on 4/5/1996, the interval would end on 4/30/1996.

Each interval was then divided into four quarters of roughly equal lengths to better understand how the firearm-purchase laws in effect were performing in regard to decreasing gun homicide rates within each interval. The average number of gun homicides (this was the most important measure of a firearm-purchase law's success) and property crimes, the percentage of South Side gun homicides and property crime out of Chicago gun homicides and property crime, and the percent change in gun homicides and property crimes from the start to the end in both the South Side and Chicago for each quarter in each time interval were measured and stored in tabular format for later data analysis.

The collected crime data from the South Side and the city of Chicago were then subjected to two types of statistical tests to determine the data's strength and relevance as a whole. The standard deviations of the gun homicide and property crime data from each interval were calculated to indicate how close or far the crime rates for each month were on average from the mean number of crimes during the interval. The statistical significance between the length of each interval and the total number of gun murders during that interval was also calculated by finding the p-value using a two-sample t-test to mathematically determine the strength of the relationship between the time elapsed between the passage of new firearm-purchase laws (which, in other words, is the length of each interval) and the total number of gun homicides during the interval.

After the South Side and Chicago crime data for each interval were collected and analyzed, the intervals were ranked by the aforementioned factors. The lesser the numerical ranking of an interval, the better it performed. For example, if Interval Six ranked 1 in terms of average monthly gun homicides, then it had the lowest average monthly gun homicides compared to the other intervals. By using this

ranking system, the intervals could be compared with each other to determine which groups of laws were correlated with the least amount of gun homicides.

REFERENCES

1. Alissapump. "Map of the Community Areas and 'Sides' of the City of Chicago." Map of Chicago Community Areas, Wikipedia, 12 Nov. 2012, en.wikipedia.org/wiki/File:Map_of_the_Community_Areas_and_%27Sides%27_of_the_City_of_Chicago.svg#filelinks. Accessed 12 May 2020.
2. Jacobs, James B. "Can Gun Control Work?" Oxford University Press, 2002. Accessed 9 November 2019.
3. United States Congress. "Library of Congress." www.congress.gov/. Accessed 12 May 2020.
4. Siegel, Michael, and Claire Boine. "What Are The Most Effective Policies In Reducing Gun Homicides?" 3-28-19-Firearm-Laws-Homicide-Deaths-Brief.pdf, Rockefeller Institute of Government, 29 Mar. 2019, rockinst.org/wp-content/uploads/2019/03/3-28-19-Firearm-Laws-Homicide-Deaths-Brief.pdf. Accessed 21 July 2021.
5. Zimring, Franklin. Firearms, Violence and Public Policy. *Scientific American*, vol. 265, no. 5, 1991, pp. 48–57. Accessed 24 September 2019.
6. City of Chicago -- Office of the Mayor, and Chicago Police Department. "Tracing The Guns: The Impact Of Illegal Guns On Violence In Chicago." MO-Gun Violence (1), City of Chicago, 27 Mar. 2014, www.chicagobusiness.com/Assets/downloads/20151102-Tracing-Guns.pdf. Accessed 16 February 2020.
7. Fontaine, Jocelyn, *et al*. "'We Carry Guns to Stay Safe.'" Urban Institute, 5 Oct. 2018, www.urban.org/research/publication/we-carry-guns-stay-safe. Accessed 22 July 2021.
(8) Skogan, Wesley. "Crime and Criminals." Scan209, December 01, 2010, The Oxford Handbook of Empirical Legal Studies, 10 Dec. 2010, http://www.skogan.org/files/Crime_and_Criminals.Oxford_Handbook_2010.pdf. Accessed 10 November 2019.
(9) National Institute of Justice. "Property Crimes." nij.ojp.gov/topics/crime/property-crimes. Accessed 16 July 2020.
(10) Chicago Police Department. CLEARMap. clearmap-chicagopd.hub.arcgis.com/. Accessed 23 March 2020.