CENTER FOR JUSTICE RESEARCH
OHIO ATTORNEY GENERAL | BGSU.

Pre- and Post-Outcomes: Ohio's Permitless Carry Law

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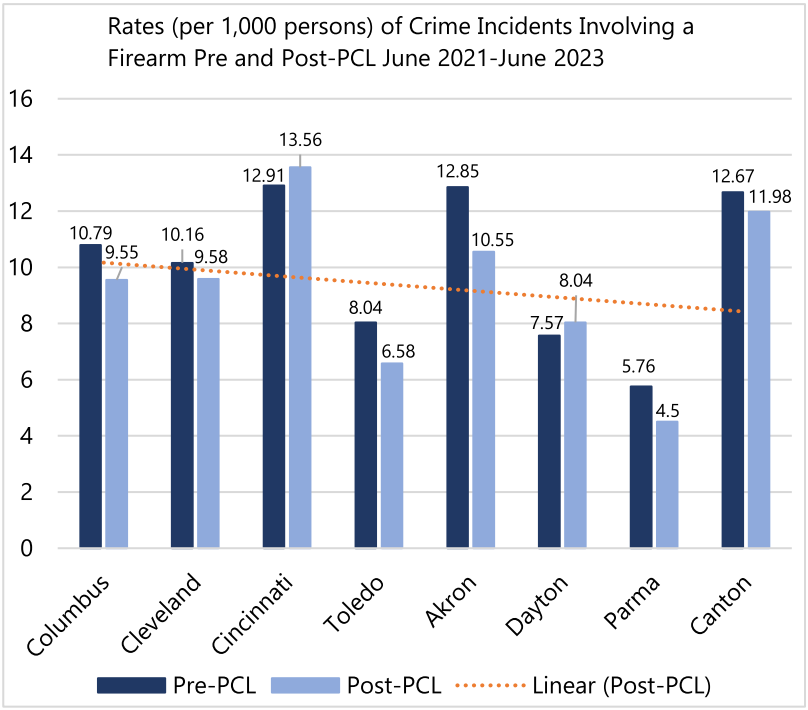
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Executive Summary

On June 13, 2022, Ohio enacted a permitless carry law (PCL), allowing Ohioans to carry a firearm without a concealed-carry license. The Center for Justice Research was tasked to explore the relationship between permitless carry and crime involving a firearm before and after the enactment of the PCL in the eight largest cities of Ohio. This exploratory study considers crime incidents involving a firearm, validated gunshot detection incidents, and the impact of PCL on law enforcement from June 2021 to June 2023. Major findings, study limitations, and future research recommendations are presented in the full report. In brief, we observed:



- Results from a trend analysis indicated a significant decrease in crime incidents involving a firearm for Akron, Columbus, and Toledo, and across all 8 cities combined from June 2021-June 2023.
- As displayed in the figure above, most cities' crime rates decreased after the PCL was enacted. Unlike the other six cities, rates in Dayton and Cincinnati increased slightly, however.
- Toledo, Parma, and Akron each experienced an average of 19% decrease in *summed* rates of crimes involving a firearm post-PCL.
- Based on data from June 2021-June 2023, the enactment of the PCL does not appear to have any appreciable effect on law enforcement injuries or deaths by firearm in the cities of interest.
- Data on gunshot detection technology for Toledo and Columbus also captured a decrease in validated crime incidents post-PCL by 23.2% and 20.6%, respectively.
- Increases in crime rates in the spring-summer months appear both before and after the PCL went into effect for most cities (see Figure 1 in full report), but this observation could be due to the influence of other factors such as time of year or structural population characteristics. This slight acceleration in crimes involving firearms was also temporary.

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Introduction

Over the last decade, nearly two dozen states have enacted a permitless or constitutional carry law allowing citizens to carry a concealed handgun without a permit. Permitless carry states, and proponents of the law, view that the right to keep and bear arms is a fundamental right protected by the U.S. Constitution, and that permitless carry laws uphold such right without the intervention or permission of the government (Ohio Attorney General, 2022; Brownlee, 2023). While proponents of the law maintain its importance to upholding individual rights, opponents of the law question whether the loosening of gun laws contribute to public safety concerns and increased crime.

Permitless Carry in Ohio

On June 13, 2022, Ohio became the 23rd state to enact a permitless carry law (PCL). The new law allows Ohio citizens to carry concealed in two ways. First, the traditional system of completing firearm training and receiving an official concealed-carry license is preserved by the new law. Alternatively, citizens 21 or older can be deemed eligible to permitless carry by passing a firearm background check through the National Instant Criminal Background Check System (NICS). Individuals who are excluded from permitless carry laws include those who have a criminal record (although some crimes may not prohibit permitless carry), have a history of mental incompetency, are subject to a civil or temporary protection order, or if the sheriff denies the license application. While the new PCL eases restrictions surrounding concealed carry, some laws are still maintained, such as forbidden-carry zones, to help ensure public safety. Further, law enforcement agencies in Ohio will continue to examine any long-term impact that the PCL has on community safety and gun violence in general (Ohio Attorney General, 2022; Ohio Attorney General, 2022).

Permitless Carry and Crime

Findings from recent research are mixed when examining constitutional carry, and other like laws. Some scholars argue that the enactment of such laws not only contributes to crime, but also poses a threat to public safety and increases fatal police encounters (Skowronski & Eith, 2022; Brownlee, 2023; & Doucette et al., 2023). Others question the true impact that these laws have on crime (Young, 2015; Manski & Pepper, 2018). Manski & Pepper (2018) suggested that available research on permitless carry laws and crime should be interpreted with caution as the utilized data in these studies are limited, which may be why such contradicting findings on this relationship exists in the literature.

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Validated Gunshot Detection Incidents

One noteworthy approach for law enforcement to address crimes involving firearms and community concerns about gun violence is ShotSpotter technology and other gunfire detection systems. ShotSpotter software works by using acoustic sensors to record firearm discharges. When the software is signaled, experts determine if the signal was a result of a firearm discharge or of another like sound. If the signal is determined to be a firearm discharge, local law enforcement is alerted to investigate the incident, all of which occurs in approximately 60 seconds (Doucette et al., 2021).

ShotSpotter technology is a rather new approach to addressing gun violence and crime as a public health concern, resulting in mixed findings on its true impact (Doucette et al., 2021). However, ShotSpotter and other acoustic gunshot detection systems have been found to positively impact police effectiveness. Such technology decreases police response time and increases awareness of where firearm incidents often occur, which may be beneficial for patrol tactics (Choi et al., 2014; Ratcliffe et al., 2018).

Data and Methods

The present exploratory study examined the impact of the PCL on crime in the eight largest cities of Ohio: Columbus, Cleveland, Cincinnati, Toledo, Akron, Dayton, Parma, and Canton. While previous literature has examined the relationship between permitless carry and crime, findings are unclear and inconsistent. As a result, the main objective of this study was to better understand the effect that permitless carry has on crime incidents involving a firearm and on police in Ohio. We also considered validated incident data detected by ShotSpotter. Collected data spanned from 1 June 2021 to 30 June 2023, and was compiled from various sources. The following sections will thoroughly discuss our data collection process and the methods of this pre-post exploratory study.

Data Collection

As previously indicated, there is concern on the data and methods utilized in former studies examining the impact of PCLs on crime and public safety (Manski & Pepper, 2018). As a result, multiple datasets were utilized in the presented study. To identify the influence of permitless carry on crime incidents involving a firearm in the eight largest cities of Ohio, data were collected from a variety of sources including the Ohio Incident-Based Reporting System (OIBRS), the Dayton and Cincinnati Open Data and Transparency Portals, and the Columbus Police Department (CPD). To consider the impact that permitless carry has on law enforcement, data on officers killed or injured while on duty was collected from the Gun Violence Archive (GVA) and the Officer Down Memorial Page (ODMP). ShotSpotter information was collected from the Toledo Police Department (TPD) and the Columbus Police Department to identify any patterns pre- and post-PCL. Table 1 depicts the origin of each utilized data source, and the following sections will thoroughly outline the data collection process and methods of this study.

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Per City Crime Data

The Ohio Incident-Based Reporting System (OIBRS) is an online portal where Ohio law enforcement agencies can voluntarily report crime statistics and use of force data per state and federal agency. OIBRS crime data reports the following variables: agency name, city population, violent crime total, murder total, rape total, robbery total, aggravated assault total, property crime total, burglary/B&E total, larceny-theft total, and motor vehicle theft total. Crime data on OIBRS website can be collected per year in three different formats: total crime rates from January-June, total crime rates from July-December, or total crime rates for the entire year. OIBRS crime data for Cleveland, Toledo, Akron, Parma, and Canton was gathered from 1 June 2021 through 30 June 2023.

Table 1. Data Sources

Per City Crime Data	
Columbus	Columbus Police Department
Cleveland	OIBRS
Cincinnati	Cincinnati Open Data Portal
Toledo	OIBRS
Akron	OIBRS
Dayton	Dayton Open Data Portal
Parma	OIBRS
Canton	OIBRS
Law Enforcement Data	
Officers Killed 2021-2023	Gun Violence Archive, Officer Down Memorial Page
Officer Injured 2021-2023	Gun Violence Archive
ShotSpotter Incidents	Toledo Police Department, Columbus Police Department
Demographics	
Per City	2020 Census – Decennial Demographic Portal, Census QuickFacts

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For the purposes of this study, acquiring the exact date (dd/mm/yyyy) of when each crime occurred and if a firearm was involved in the incident was essential. A request for more specific crime data was made for each city of interest. In response, OIBRS provided the following information: report code (ORI), agency name, date of the incident (mm/dd/yyyy), National Incident-Based Reporting System (NIBRS) code and description, weapon code, description of weapon involved, and the total number of crime incidents per indicated day. Once the CJR team received this dataset from OIBRS, it was cleaned and divided by city. Crime data involving the following firearm categories was included in the final sample: automatic handgun, BB and pellet gun, firearm, fully automatic rifle, handgun, machine pistol, other firearm, other fully automatic firearm, rifle, semi-automatic assault firearm, semi-automatic sporting rifle, and shotgun.

Open Data Portal – Cincinnati and Dayton

For cities where OIBRS did not provide crime data (Columbus, Cincinnati, and Dayton), other sources were utilized. Both the city of Cincinnati and Dayton provide public and accessible governmental data on their data portals. The goal of providing such data to the public is to increase accountability, improve local and governmental services, stimulate economic activity, and to be transparent about city budgets and operations. Both Cincinnati and Dayton provide detailed crime incident data on their Open Data and Transparency Portals, which are updated regularly. Such files were used for this project.

The crime data provided on the data portals include multiple variables such as location of the incident (i.e., neighborhood, police sector, and longitude and latitude), victim and suspect characteristics (i.e., race, age, and gender), and other detailed information of each incident. Further, all crime information is included, whether a firearm was involved or not. Data for this project was collected for June 2021 through June 2023, and was thoroughly cleaned to align with the variables provided in the OIBRS data. The following variables for both the Cincinnati and Dayton crime data were considered: crime description, date (mm/dd/yyyy), and weapon description. All crime incidents that did not involve a firearm, listed under the "weapon description" variable, were removed from the final sample.

Columbus Police Department Crime Data

Crime data for the city of Columbus was rather difficult to acquire as their crime data are not available on OIBRS website, nor does the city have an Open Data Portal. However, crime incident data were provided to the research team by the Columbus Police Department. Such data included the following variables: report number, class – crime classification, crime description, date (mm/dd/yyyy), and weapon classification. Crime incidents involving a firearm comprised in our sample include those classified as "by default," "conditional firearm," and "firearm listed."

Law Enforcement Data

Data on law enforcement officers being injured or killed by a firearm while on duty was collected from the Gun Violence Archive (GVA) and the Officer Down Memorial Page (ODMP). The GVA collects data on gun violence incidents from more than 7,500 law enforcement, media, governmental, and commercial sources daily. The GVA provides their data on multiple publicly available datasets. For the purposes of this study, data were extracted from two datasets: "Officer Involved Incident – Killed" and "Officer Killed or Injured – Injured."

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GVA datasets report the following variables: incident date, state, city or county, address, officer gender and age, and victim and/or offender name (if applicable). Further, a short summary of the incident is provided, and relevant news articles are attached per incident. Data on officers killed by a firearm in Ohio and in the cities of interest was collected from June 2021 to June 2023 from the "Officer Involved Incident - Killed" datasets, which are broken down by year. In some cases, it was difficult to determine if an officer killed by a firearm was accidental, such as an unintended service weapon discharge. For these incidents, the OMDP was referenced. The ODMP is a non-profit organization that is dedicated to honoring fallen law enforcement officers in the United States. This organization updates their website when a new incident of a fallen officer occurs and provides thorough detail on the officer and their means of on-duty death. The ODMP was referenced only when it was unclear if an officer's death by a firearm was accidental or not.

To explore the rate of on-duty officer injury resulting from a firearm, the "Officer Killed or Injured – Injured" file, provided by the GVA, was referenced. Similar to fallen officer's data, injury data were collected from June 2021 to June 2023. Only incidents where an officer was injured due to a firearm was included. Accidental firearm injuries, such as ricocheting bullets and accidental firearm discharges, were excluded from the final sample. No other source was needed for this data as the GVA indicated when a firearm injury was accidental or a result of an encounter with an armed individual.

ShotSpotter Data – Toledo and Columbus

Some cities of interest have implemented ShotSpotter technology to assist law enforcement with counteracting gun violence. For this study, the use of ShotSpotter technology was considered to better understand how some police agencies are responding to gun violence and public safety concerns surrounding firearms. While cities may utilize ShotSpotter technology, and other gun detection software, such data are often unavailable. Table 2 thoroughly describes the use of ShotSpotter technology for each city of interest.

ShotSpotter data were provided for Columbus, by the Columbus Police Department (CPD), and Toledo, by the Toledo Police Department (TPD) from June 2021 through June 2023. TPD ShotSpotter data included the following variables: crime, date (mm/dd/yyyy), time, location details, and address of the incident. ShotSpotter data for Toledo only included incidents defined as "validated." According to TPD, validated incidents are crime incidents where an arrest was made, a gun was recovered, bullet casings were found, a victim was hit, a building or vehicle was hit, or where there was a verified crime incident, but it was outside of TPD's range of patrol. It should be noted that TPD only provided ShotSpotter incidents where a crime actually occurred and where the incident was "validated." This means more ShotSpotter incidents could have occurred, but they did not fit the listed classifications, and, therefore, were not included in the sample. Provided ShotSpotter data for Columbus included the following variables: report number, class and crime description, date (mm/dd/yyyy), and weapon description. Incidents where the weapon variable was defined as being "firearm listed" or "conditional firearm" were

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considered in the final sample. Like TPD, CPD only provided ShotSpotter incidents where an actual crime occurred and where a firearm was involved, thus, more ShotSpotter incidents could have transpired during our interested timeframe but might not have been presented by CPD.

Table 2. Overview of Gunfire Detection in Each City

Use of ShotSpotter	
Columbus	Columbus implemented ShotSpotter in 2018 over a 12.6-mile coverage. Columbus PD provided ShotSpotter data.
Cleveland	Implemented ShotSpotter May 2023 and covers all five Neighborhood Police Districts. Data are unavailable.
Cincinnati	Implemented ShotSpotter in 2017 in select neighborhoods. As of Nov. 2021, Cincinnati provides ShotSpotter data in their calls for service data – which is publicly available. However, the coding for these data is unclear and only goes through Jan. 2023. The owner of this dataset has been contacted in attempt to receive the rest of 2023 data and a codebook. There has been no response. As a result, Cincinnati ShotSpotter data were not consulted.
Toledo	Toledo implemented ShotSpotter in June 2019 over a 12-mile radius. Toledo PD provided ShotSpotter data.
Akron	Does not use ShotSpotter.
Dayton	Dayton implemented ShotSpotter in 2019 over a 3-mile radius. Intense backlash from the community resulted in Dayton PD discontinuing the use of ShotSpotter after December 2022.
Parma	Does not use ShotSpotter.
Canton	Implemented ShotSpotter in 2013. Canton PD switched to Wi-Fiber Connect-n-Protect and BlueForce technology in 2019, which covers approximately 25 square miles. Data for Canton gunshot detection are not available.

City Characteristics

Table 3 depicts demographical characteristics for the cities of interest. These data were collected from the 2020 Census - Decennial Demographic Portal and the Census QuickFacts page. These descriptives are included to provide details about the cities under evaluation and serve as reference to how the cities compare to one another on key structural variables known in the literature to significantly contribute to crime. To note, per city crime rates, depicted in this report, were based on the total population for each city provided by the 2020 Census[1].

With a few exceptions, the cities studied herein are similar on many structural characteristics despite the varied population sizes. Parma, the second smallest city, differs moderately from the other cities. Its population is mostly white, has a lower percentage of persons living in poverty, those aged 15 to 24, and female-headed households. Parma also has

[1] Crime Rate = (Total # of Crime Incidents Involving a Firearm)(1,000)/Total City Population

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one of the smallest percentages of persons with less than a high school diploma or equivalent and has the highest median household income across the eight cities. Columbus, Cincinnati, and Cleveland rank as the topmost populated locales. Columbus fares better in percentage of persons living in poverty than the other largest cities, higher median household incomes, and more persons in the labor force compared to Cleveland and Cincinnati. Cleveland, on the other hand, has the lowest median household income, highest percentage of persons in the population without a high school diploma or equivalent, persons in poverty, and female-headed households. While the purpose of this analysis is to explore the pre-PCL and post-PCL effects on crimes involving firearms, future consideration of how the structural variables in Table 3 may provide some additional context to the findings that follow.

Table 3. Cities of Interest: Demographics

	Columbus	Cleveland	Cincinnati	Toledo	Akron	Dayton	Parma	Canton
Population Characteristics								
Total Population	905,748	372,624	309,317	270,871	190,469	137,644	81,146	70,872
Population Density	4,116.3	4,793.8	3,973.8	3,356.3	3,075.6	2,466.3	4,053.2	2,692.7
Population ages 15 to 24	16.1%	13.5%	17.6%	14.4%	14.3%	16.7%	11.3%	13.4%
Population in Poverty	18.4%	31.4%	24.7%	24.5%	23.0%	28.6%	9.9%	30.3%
Race								
White	53%	34%	48%	58%	55%	48%	84%	62%
Nonwhite	47%	66%	52%	42%	45%	52%	16%	38%
Hispanic or Latino	7.7%	13.1%	5.1%	8.9%	3.3%	5.7%	6.9%	5.0%
Gender								
Male	49%	49%	48%	48%	48%	49%	49%	48%
Female	51%	51%	52%	52%	52%	51%	51%	52%
Household Demographics								
Female Head of Household	34.1%	42.1%	40.2%	37.6%	38.2%	39.2%	29.9%	39.1%
Median Household Income	$58,575	$33,678	$45,235	$42,671	$42,129	$37,536	$60,590	$34,611
Living in the Same House for at least a Year	79.1%	82.6%	77.7%	83.7%	84.2%	74.6%	86.5%	81.8%
Employment								
Percent in Labor Force Ages 16+	70.5%	59.4%	66.3%	62.1%	62.5%	57.4%	65.6%	59.2%
Education								
Less Than Graduate from High School	10.7%	17.2%	9.8%	15.1%	12.9%	5.5%	6.1%	12.6%

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Findings

Permitless Carry and Crime

Table 4 presents the raw numbers, rates, and percent change pre- and post-PCL for the eight cities separately and combined. We calculated percent change on crime rates involving firearms, as seen in Table 4 below for the 12.5 months prior to the PCL and 12.5 months post. Only two cities experienced a slight increase in crime rates involving firearms; these were Cincinnati at 5% and Dayton at 6%. The remaining cities' crime rates, as displayed in Table 4, declined with Parma, Akron, and Toledo having the highest percentage change in rates, 22%, 18%, 18%, respectively after the PCL went into effect.

Table 4. Raw Numbers, Rates, and Percent Change in Crime Rates Involving Firearms Pre- and Post-PCL

Cities	Pre-PCL	Pre-Rates	Post-PCL	Post-Rates	Percent Change[a]
Columbus	9,770	10.79	8,638	9.55	-12
Cleveland	3,781	10.16	3,575	9.58	-6
Cincinnati	3,991	12.91	4,196	13.56	5
Toledo	2,179	8.04	1,783	6.58	-18
Akron	2,446	12.85	2,007	10.55	-18
Dayton	1,043	7.57	1,111	8.04	6
Parma	468	5.76	365	4.5	-22
Canton	898	12.67	848	11.98	-5
Total	24,576	10.51	22,523	9.63	-8

[a] *Rounded to nearest whole number.*

Figure 1 displays a line graph of crime incident rates involving a firearm per 1,000 persons, and Table 5 presents the rates in numeric form covering the months and years under study from June 2021-June 2023. Seasonal increases in crime rates in the spring-summer months appear both before and after the PCL went into effect for most cities. We continue to observe this seasonality influence most markedly in 2023 in the late spring and summer for Cincinnati and Cleveland. Cincinnati and Canton also showed increases in October and September 2022, respectively, and both cities witnessed another rise in crimes involving guns in December 2021 and April 2022. Rates in all cities, except for Akron and Parma, increased after the PCL goes into effect for about six weeks and then fell back into similar trends, if not decreased, that were observed pre-PCL.

Courtesy of 2A Maryland

Figure 1: Rates of Crime Incidents Involving a Firearm per 1,000 Persons – Eight Largest Cities in Ohio

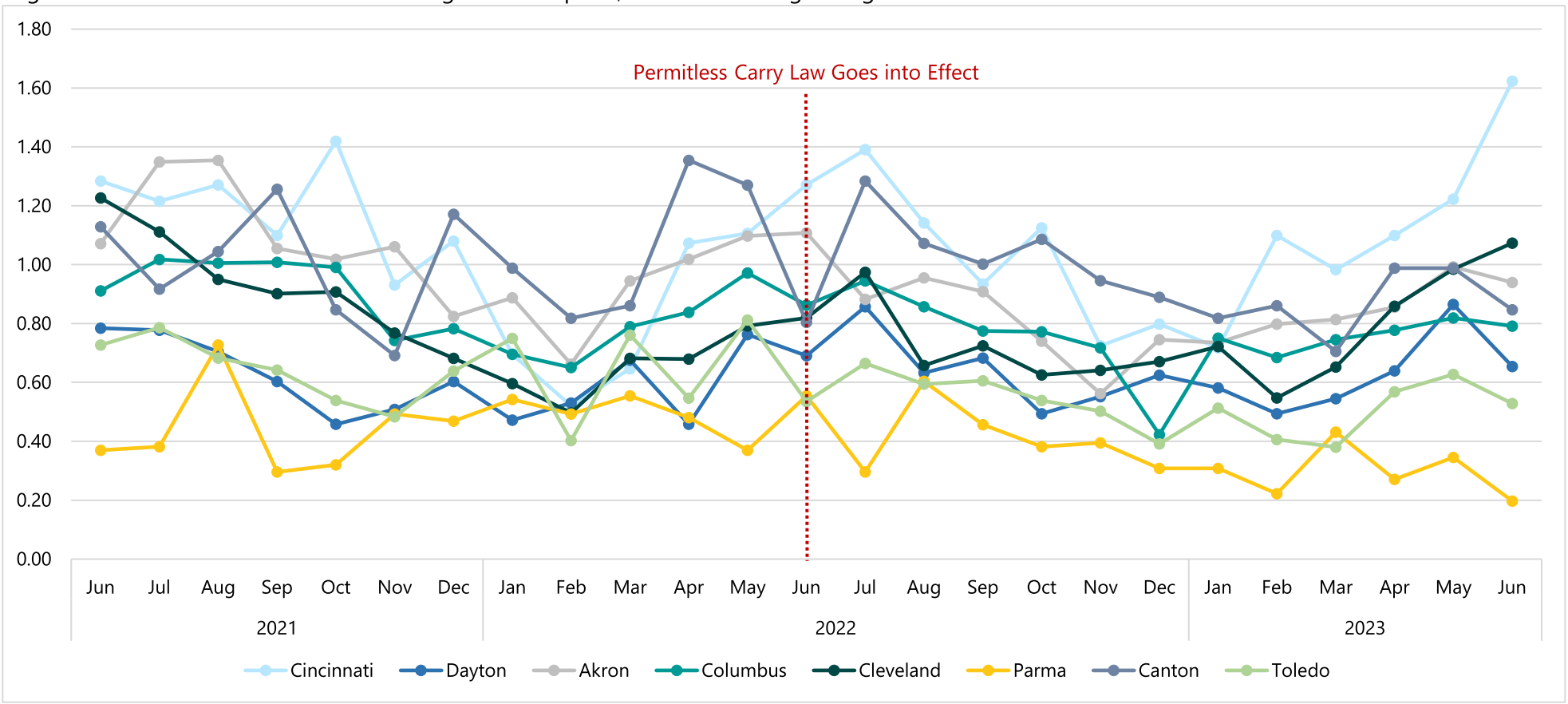


Table 5. Rate of Crime Incidents Involving a Firearm per 1,000 Persons – Eight Largest Cities in Ohio

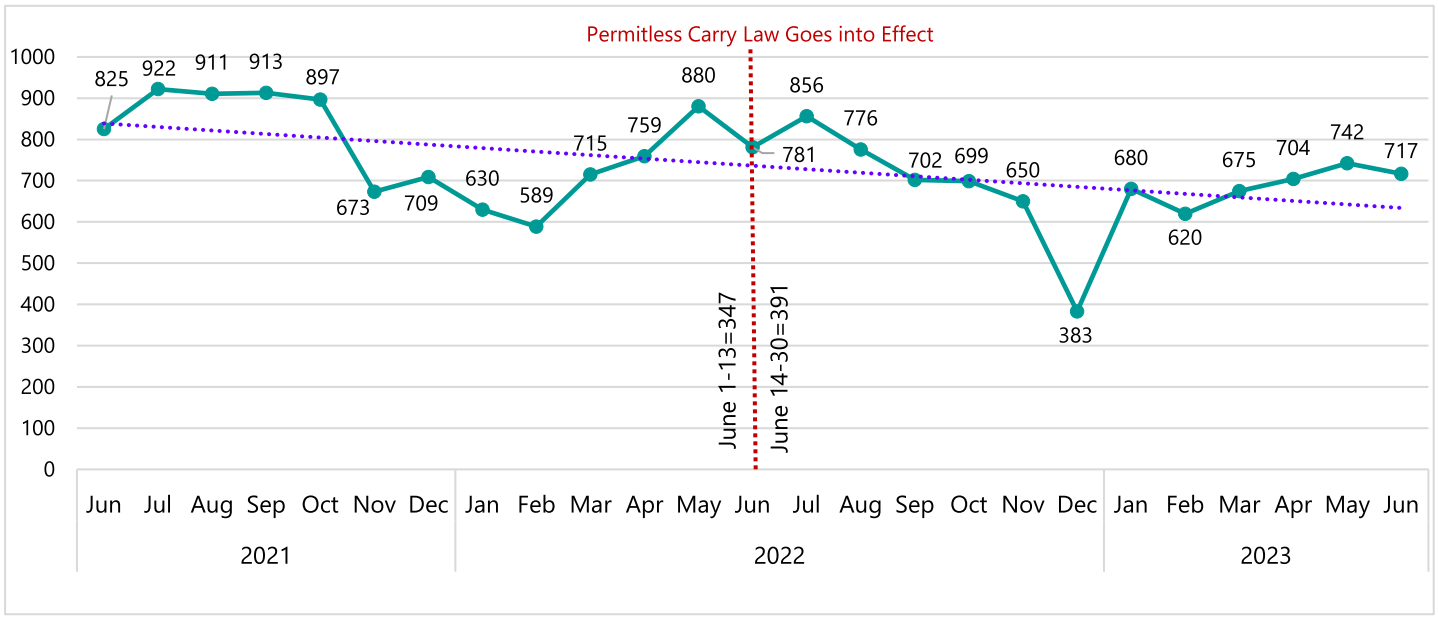
	2021							2022														2023					
	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun 1-13	Jun 14-30	All Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Columbus	0.91	1.02	1.01	1.01	0.99	0.74	0.78	0.70	0.65	0.79	0.84	0.97	0.38	0.48	0.86	0.95	0.86	0.78	0.77	0.72	0.42	0.75	0.68	0.75	0.78	0.82	0.79
Cleveland	1.23	1.11	0.95	0.90	0.91	0.77	0.68	0.60	0.50	0.68	0.68	0.79	0.36	0.46	0.82	0.97	0.66	0.72	0.63	0.64	0.67	0.72	0.55	0.65	0.86	0.98	1.07
Cincinnati	1.28	1.22	1.27	1.10	1.42	0.93	1.08	0.70	0.52	0.65	1.07	1.11	0.56	0.71	1.27	1.39	1.14	0.93	1.13	0.72	0.80	0.72	1.10	0.98	1.10	1.22	1.62
Toledo	0.73	0.79	0.68	0.64	0.54	0.48	0.64	0.75	0.40	0.76	0.55	0.81	0.27	0.26	0.53	0.66	0.59	0.61	0.54	0.50	0.39	0.51	0.41	0.38	0.57	0.63	0.53
Akron	1.07	1.35	1.35	1.06	1.02	1.06	0.82	0.89	0.66	0.95	1.02	1.10	0.50	0.61	1.11	0.88	0.96	0.91	0.74	0.56	0.75	0.74	0.80	0.81	0.86	0.99	0.94
Dayton	0.78	0.78	0.70	0.60	0.46	0.51	0.60	0.47	0.53	0.68	0.46	0.76	0.24	0.45	0.69	0.86	0.63	0.68	0.49	0.55	0.62	0.58	0.49	0.54	0.64	0.86	0.65
Parma	0.37	0.38	0.73	0.30	0.32	0.49	0.47	0.54	0.49	0.55	0.48	0.37	0.27	0.28	0.55	0.30	0.60	0.46	0.38	0.39	0.31	0.31	0.22	0.43	0.27	0.35	0.20
Canton	1.13	0.92	1.04	1.26	0.85	0.69	1.17	0.99	0.82	0.86	1.35	1.27	0.32	0.48	0.8	1.28	1.07	1.00	1.09	0.95	0.89	0.82	0.86	0.71	0.99	0.99	0.85

Courtesy of 2A Maryland

Per City Figures

The figures that follow display the total crime counts for each city under study. We present the raw numbers rather than rates in these line graphs to capture the detail that is sometimes obscured when comparing rates across units of analysis. Since the PCL went into effect mid-June, we provide a red indicator line denoting this and the values on pre and post. A trendline is also included to depict changes in gun crime over time. As stated previously, for most cities, we see the typical seasonal increases in crimes that tend to occur across the country in spring and summer months. Bullet point observations follow each city's figure.

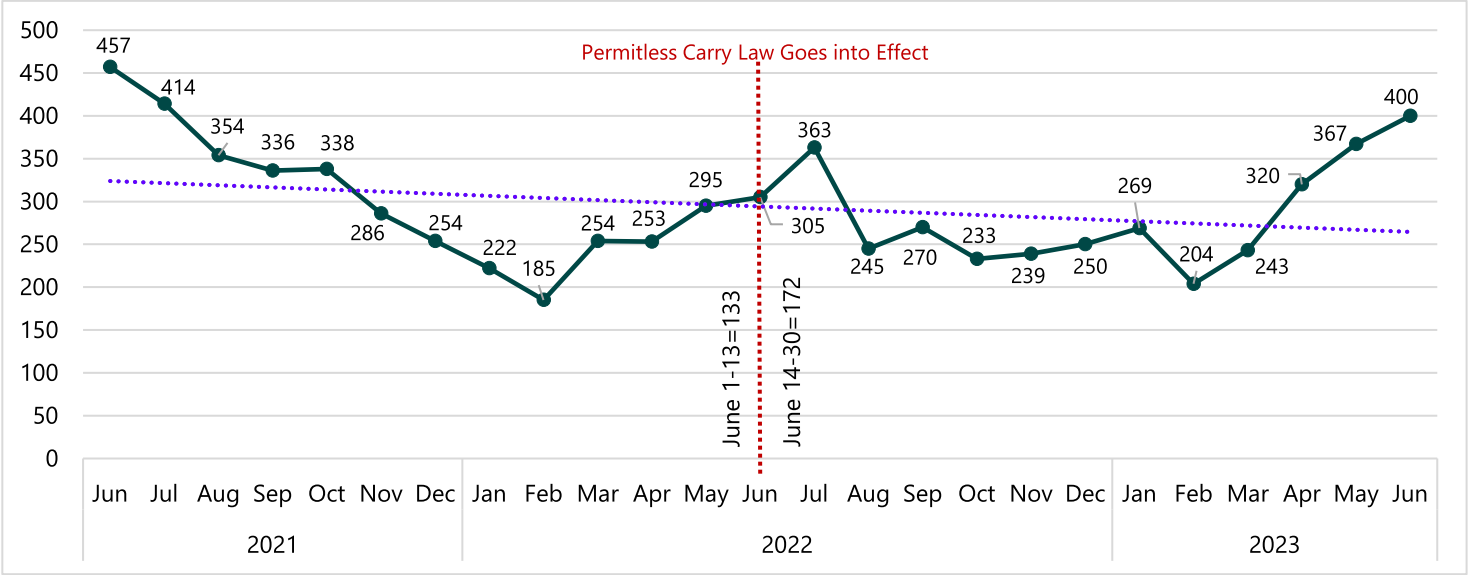
Figure 2. Total Crime Incidents Involving a Firearm in Columbus, Ohio



Courtesy of 2A Maryland

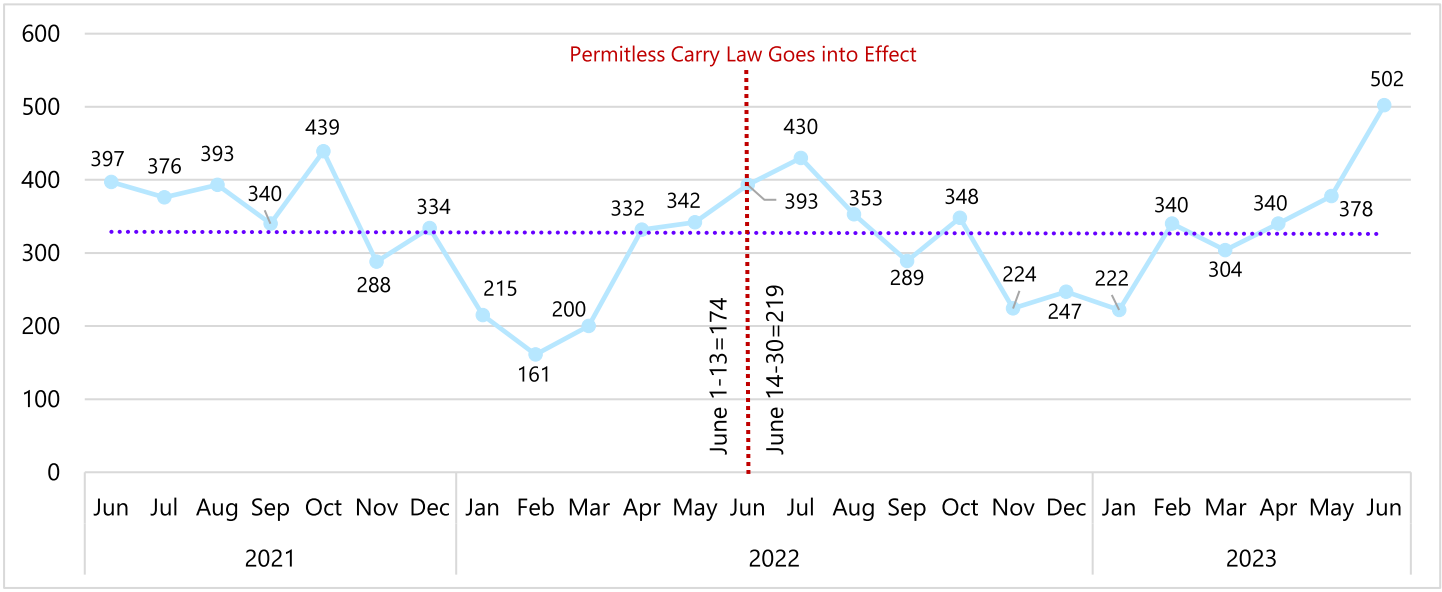
- The trend line for crimes involving firearms in Columbus tended to remain steady despite a sizable decrease by over 40% from November 2022 to December 2022, almost 6 months post-PCL. A similar decline did not occur in the same months in 2021.
- Seasonality effects are also evident in the Columbus crime counts involving firearms.

Figure 3. Total Crime Incidents Involving a Firearm in Cleveland, Ohio



- After June 2021, where crimes involving Cleveland peaked at 457, crimes steadily decreased until February 2022, when after a low of 185, the trend line began to rise until July 2022, after the PCL goes into effect.
- Steady numbers of crimes occurred the rest of 2022 with 2023 starting out relatively the same as the previous year during January and February. Crime counts had a marked increase beginning in March 2023, only to end June 2023 at 400 crimes involving firearms.

Figure 4. Total Crime Incidents Involving a Firearm in Cincinnati, Ohio

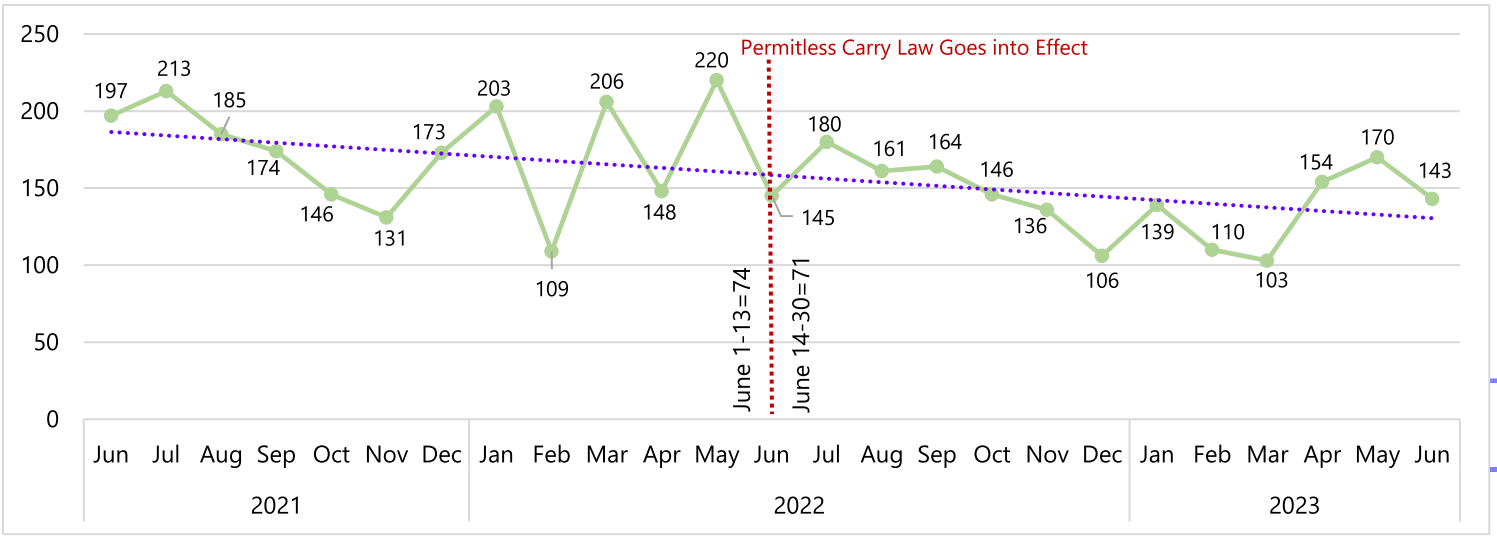


- Cincinnati's number of crime incidents involving a firearm over the study period slightly to moderately increased after the PCL law goes into effect.

Courtesy of 2A Maryland

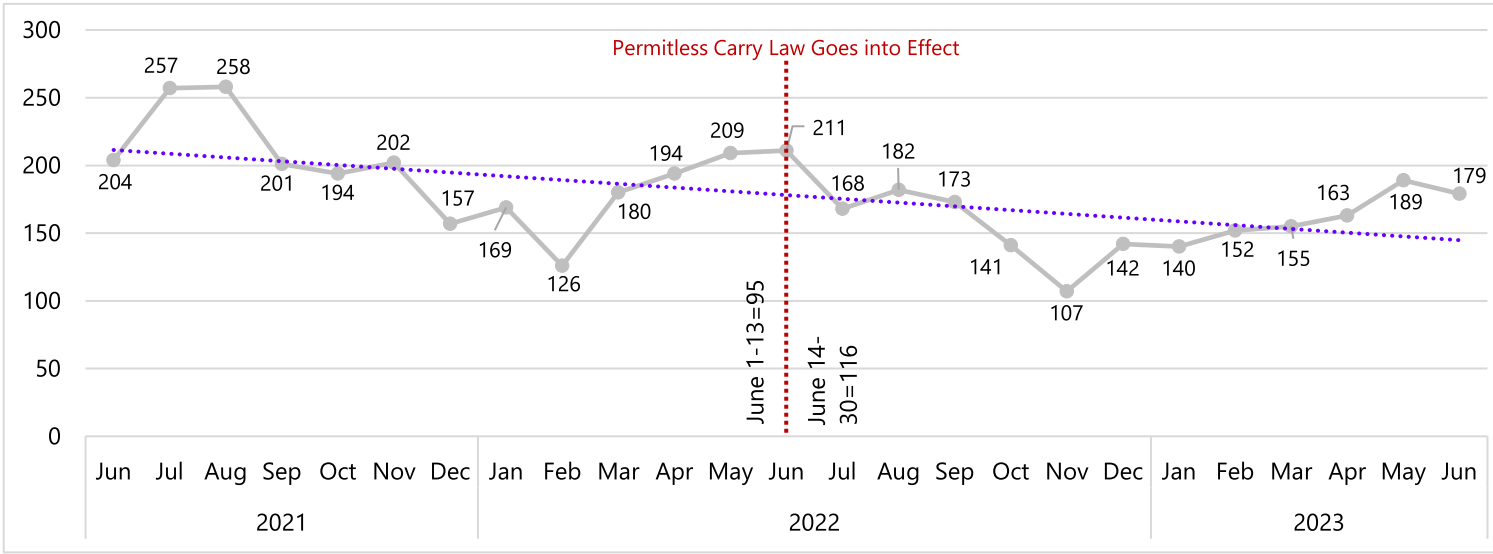
- Crimes dropped later in the summer months and remained relatively steady until late spring, early summer when the total crimes involving a firearm increased to a high of 502[2], which was the largest number of gun-involved offenses in the past two years.

Figure 5. Total Crime Incidents Involving a Firearm in Toledo, Ohio



- Toledo's number of crimes involving firearms declined slightly after the PCL went into effect other than the initial rise from June to July 2022.
- Toledo's highest number of crimes involving weapons occurred in May 2022 at 220 just before the PCL went into effect.

Figure 6. Total Crime Incidents Involving a Firearm in Akron, Ohio



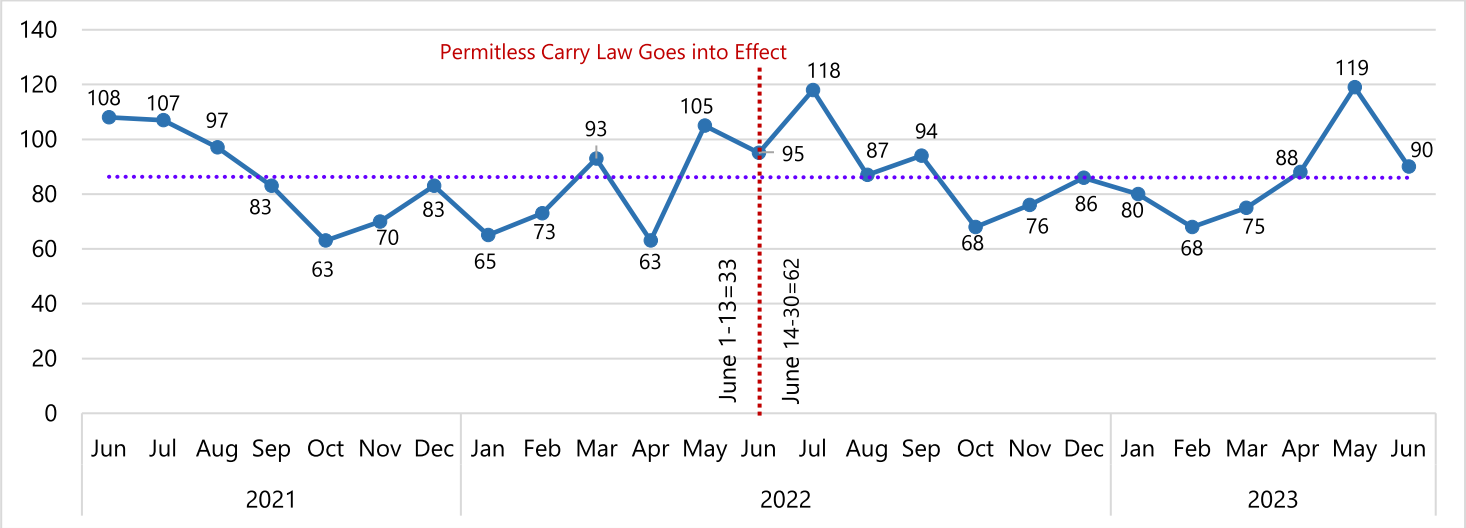
- Aside from a few outliers for crimes involving a firearm, the numbers, while higher pre-PCL, were relatively stable, especially post-PCL across the months under study for Akron.
- July and August 2021 were two months where crimes involving firearms were at their peak. At no other point did Akron see such high numbers.

[2] We investigated the anomalous spike in crimes involving guns in June 2023 and learned that Cincinnati had an uptick in shootings from May through June (SpectrumNews1, 6/8/2023) with three separate shootings occurring on one night (Cincinnati.com, 6/14/2023) in mid-June.

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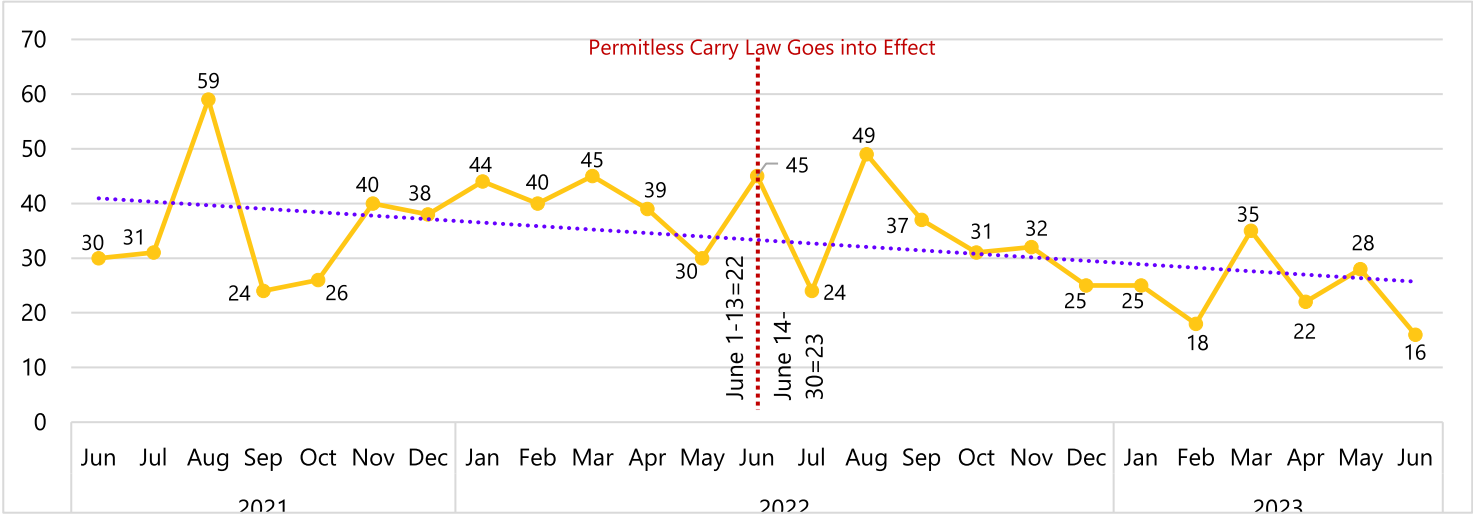
- Substantive declines in February 2022 and November 2022 were observed.
- Akron is one of the two cities (Parma, the other) under study where there was a decrease in crimes within several weeks post-PCL and then rose slightly in August 2022.

Figure 7. Total Crime Incidents Involving a Firearm in Dayton, Ohio



- Dayton's pattern of crime incidents involving a firearm showed a somewhat moderate rise pre- to post-PCL and then dropped to similar numbers of these crimes observed in the months preceding the PCL until May of 2023, where there were similar numbers of offenses.
- May 2023 to June 2023, almost one-year post-PCL we observed a decrease that was similar to what occurred the year prior for July to August.

Figure 8. Crime Incidents Involving a Firearm in Parma, Ohio

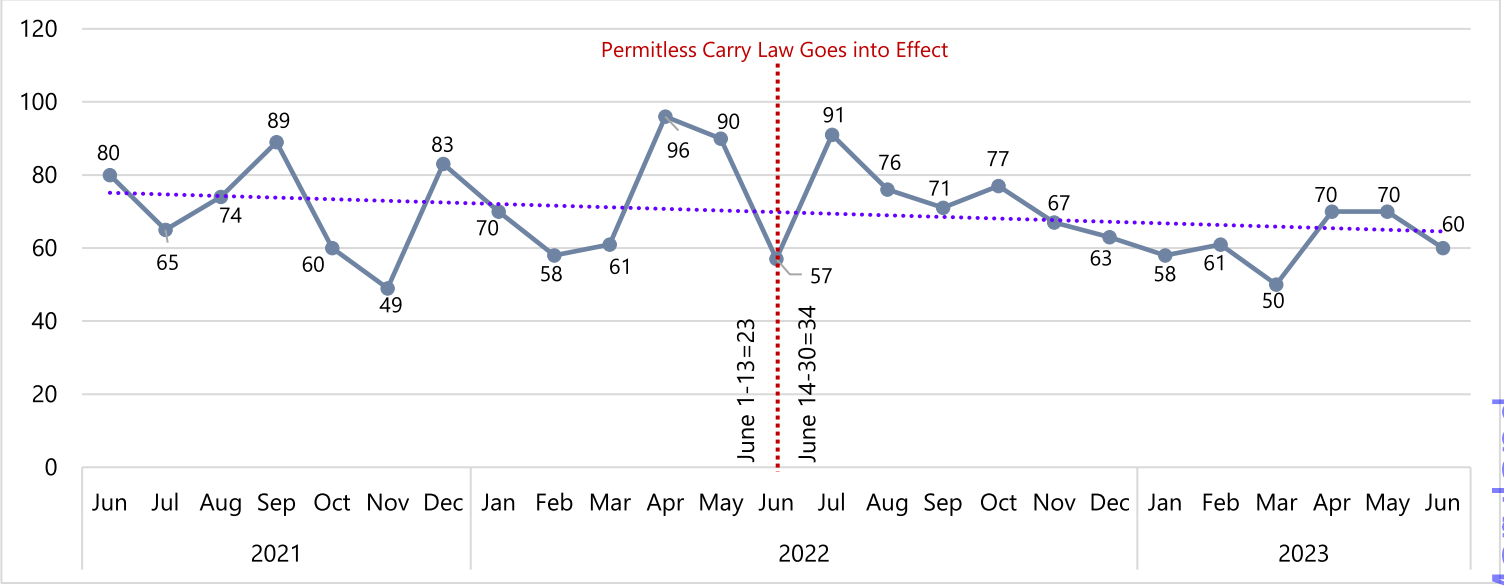


- Parma is the second of the two cities (i.e., Akron and Parma) that witnessed a decline in crimes within the month to six weeks following the mid-June date of when the PCL went into effect.

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- A steep rise in crimes occurred from July 2022 to August 2022, only to fall back into pre-PCL patterns, as far as climb and fall, though there were fewer monthly occurrences after PCL.

Figure 9. Total Crime Incidents Involving a Firearm in Canton, Ohio



- Canton's pre-PCL fluctuated with varying increases and decreases over the months under study.
- Post-PCL, after an increase of nearly 60% from June to July in 2022, the numbers of crimes involving firearms continued to steadily decline from August 2022-June 2023 except for an increase in April and May of 2023.

Mann-Kendall Test for Trend and T-Test Analyses

To determine if there were any consistently increasing or decreasing trends in the data, we ran the Mann-Kendall Trend Test (MK). To test for any significant differences pre- and post-PCL, we ran Independent Samples t-test. Given that the PCL went into effect in mid-June, to perform these statistical tests we divided the crimes involving firearms data for each month into biweekly figures, which differs from the rest of the report where we captured data monthly. Results are noted in Table 6. Interestingly, MK statistics indicated a significant decreasing trend in crime incidents in Akron, Columbus, Toledo, and across all cities combined from June 2021 to June 2023. The unit of Sen's Slope (S) indicates the magnitude of the trend per month across the entire period where a negative sign means the trend is decreasing and a positive S value means the trend is increasing. Thus, across the entire period there was a decrease in crime incidents from June 2021 to June 2023 when measured bi-weekly. The cities driving this decreasing trend were Akron, Columbus, and Toledo.

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For the independent t-tests, we coded pre-PCL as 0 and post-PCL as 1 and compared differences in incidents between the two. The results showed that there were significant variations in the average number of incidents in Columbus, Akron, Parma, and Toledo before and after implementation. Unlike the MK findings, there were no differences pre- and post-PCL enactment for all the cities combined. Generally, then, crime incidents involving a firearm were decreasing across the timespan under study. There may have been a difference in crimes following the law taking effect in Columbus, Toledo, Parma, and Akron, or, more likely, these findings are more consistent with the broad decreasing trend in crimes from June 2021 to June 2023.

Table 6. Mann-Kendall and Independent Samples T-tests Results

	Mann-Kendall				Independent Samples T-Test		
City	tau	*p*-value	Sen's Slope		*t*-value	*df*	*p*-value
Columbus	**-0.231**	**0.02**	**-2**		**2.007**	**48**	**0.05**
Cleveland	-0.19	0.056	-0.778		0.645	48	0.522
Cincinnati	-0.047	0.642	-0.279		-0.482	48	0.632
Toledo	**-0.263**	**0.018**	**-0.566**		**2.613**	**40.3**	**0.013**
Akron	**-0.289**	**0.004**	**-0.775**		**2.87**	**48**	**0.006**
Dayton	-0.041	0.692	-0.055		-0.801	48	0.427
Parma	-0.187	0.064	-0.125		**2.42**	**48**	**0.019**
Canton	-0.075	0.458	-0.078		0.709	48	0.481
All Cities Combined	**-0.209**	**0.035**	**-4.5**		1.396	48	0.169

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Impact of Permitless Carry on Law Enforcement

As discussed in the literature review earlier in this report, studies have found that less restrictive firearm laws, such as permitless carry, are positively correlated with higher numbers of officer involved shootings, including fatal shootings. Figure 10 represents the number of officers injured or killed by a firearm during a crime incident. We broke down these data into months that aligned with this study's dates. The second half of 2021 witnessed eight police officer injuries or deaths by a firearm in Ohio, three of which occurred in Ohio's eight largest cities. In the months following the PCL, there were four such incidents with one from the studied cities. Post-PCL, there was an increase of one additional officer injured/killed in the last half of 2022 compared to the first half of 2023. In the first half of 2023, there were three injuries or deaths and in the entire year of 2022, there were five. Data for the remaining six months of 2023 will help capture whether these numbers are on par with earlier years or something else is occurring

that may or may not be a result of the enactment of the PCL. Figure 11 denotes the date, city location, and officer position of those killed or injured in the cities of interest pre- and post-PCL.

Figure 10. Police Officers Injured or Killed by a Firearm in the Cities of Interest and All of Ohio

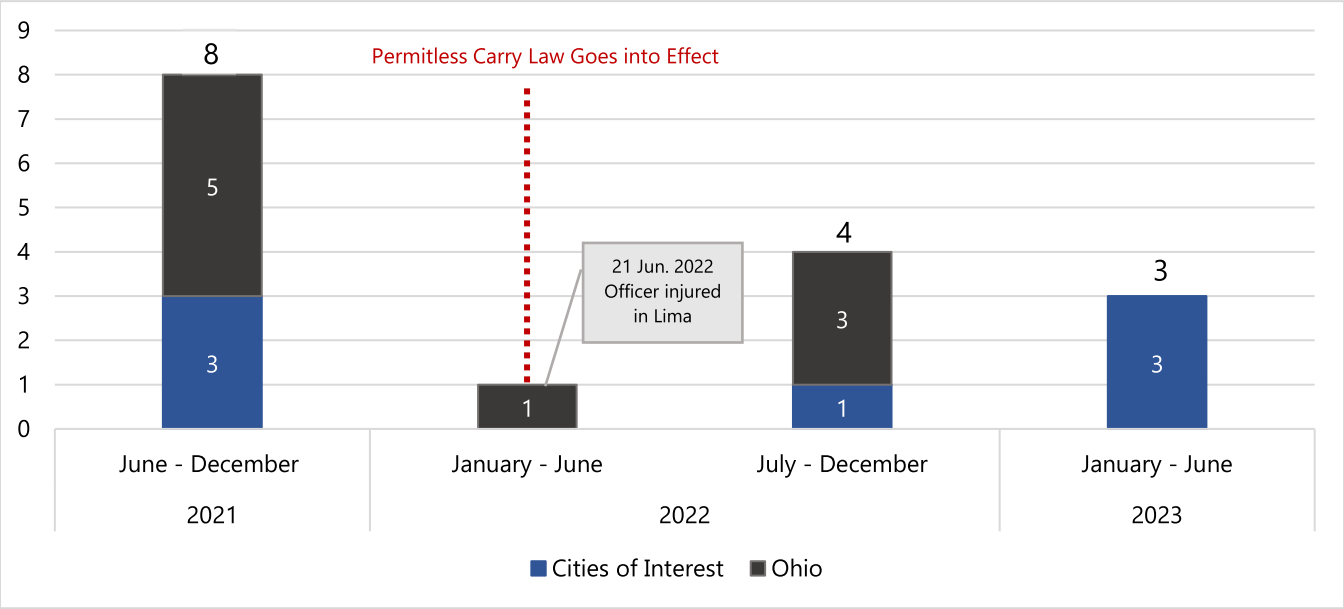
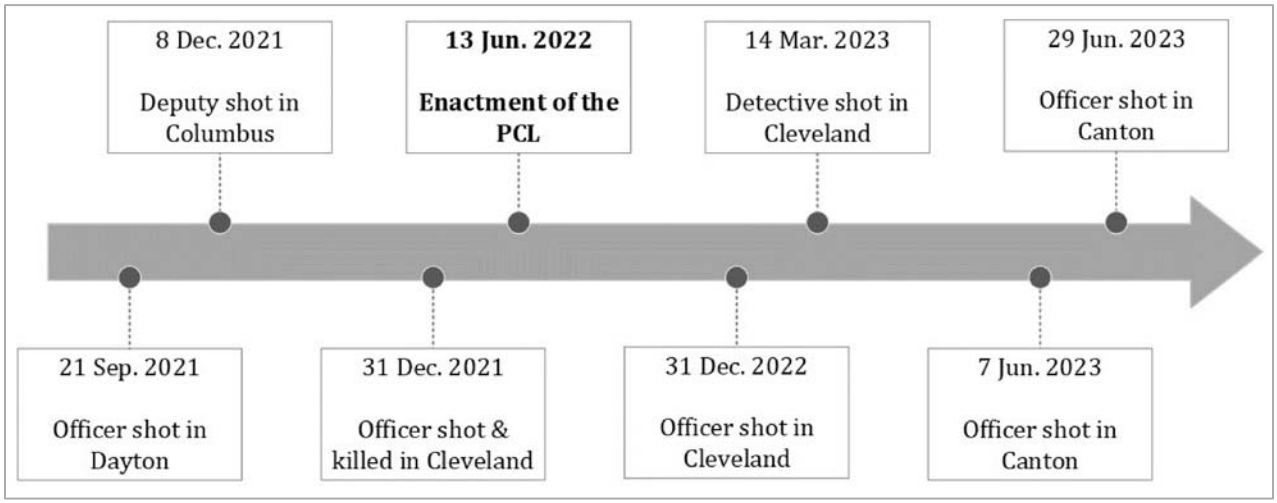


Figure 11. Timeline of Officers Injured or Killed for the Cities of Interest Pre- and Post-PCL



ShotSpotter Technology

Observing data from the ShotSpotter Technology systems in Toledo and Columbus was another method we used to glean into the possible effects pre- and post-PCL since these systems provide information on guns fired in a particular area. The patterns observed, see figures 12 and 13 below, are not dissimilar to those we noted on crimes involving firearms data. Toledo's rates were higher than Columbus's for nearly any given month under study, yet the

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general trend follows along the same pattern for both cities pre- and post-PCL in that both cities witnessed a decrease post-PCL. Toledo's rates decreased by 23.2% (pre-PCL raw numbers were 1,509 and post counts were 1,236) and Columbus saw a 20.6% drop-in rates (pre-PCL counts were 877 and post-PCL at 700) of shots detected after the PCL went into effect. A few other cities use gunfire detection systems, including ShotSpotter, but only Toledo and Columbus were able to provide us the data for the months under study. Refer to Table 2 for an overview of gunfire detection systems in each city.

Figure 12. Rate of ShotSpotter Incidents per 1,000 Persons in Toledo

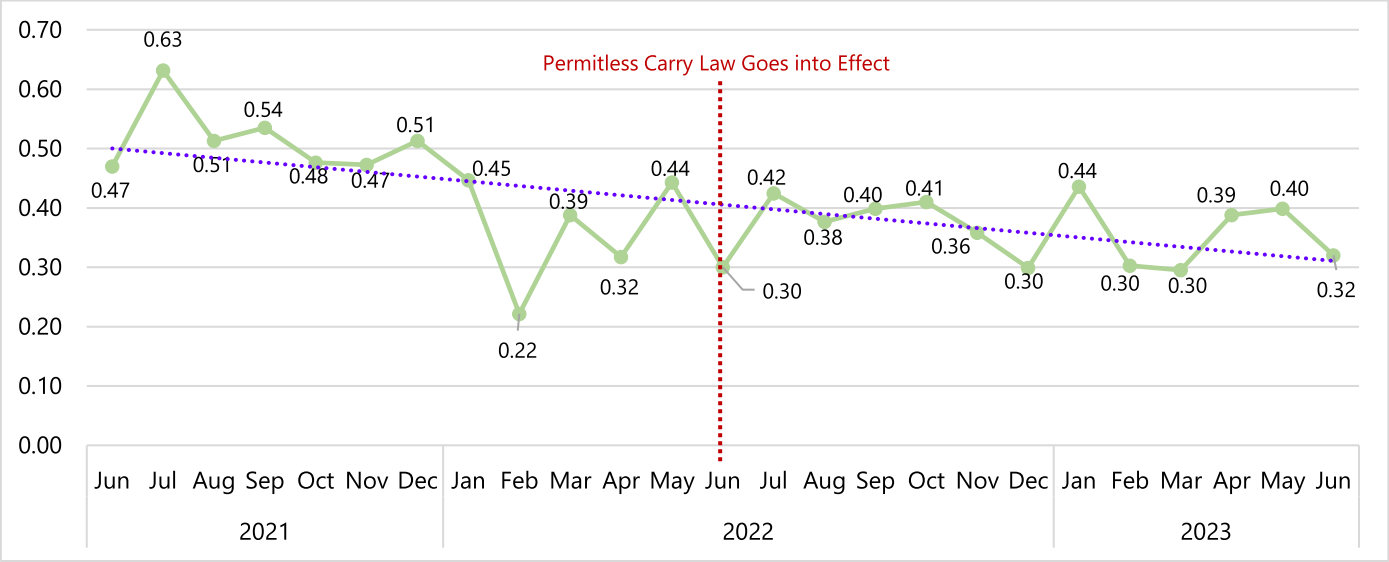
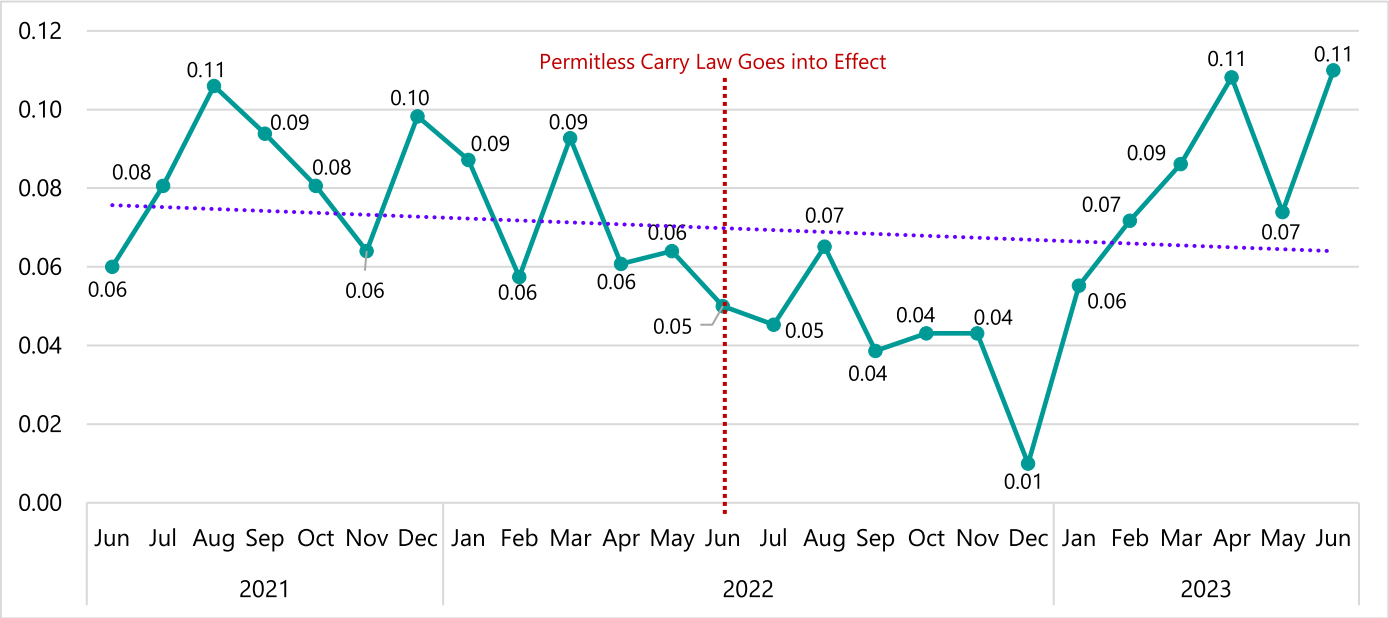


Figure 13. Rate of ShotSpotter Incidents per 1,000 Persons in Columbus



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Discussion and Conclusion

In sum, our observations of the trends pre- and post-PCL lead us to surmise that to date, the effects of the PCL are minimal on crime rates involving firearms, number of shots detected, and law enforcement officer injuries and deaths and generally show a decrease. To assess whether these decreases were significant, we conducted a trend analysis. Results indicated a significant decline in crime incidents involving a firearm for Akron, Columbus, and Toledo, and across all cities combined from June 2021-June 2023. When comparing the average number of crime incidents involving firearms in each city and then compared pre- and post-PCL, the results showed that four cities significantly differed before and after the enactment of the law. These were Columbus, Toledo, Akron, and Parma. We did not observe significant variations for any other city or when the cities' values were combined and means tested.

Some limitations should be mentioned when considering the findings of this exploratory study. First, our study examined the impact of permitless carry on eight cities over a period of two years, 1-year pre and 1-year post-PCL. As a result, the generalizability of the findings should be considered. Future studies should analyze the impact of permitless carry, and other like laws, in other cities and states over a longer period of time to gain better insight on how changes to firearm laws impact crime over time and in different areas. Moreover, our study examined the largest cities of Ohio, thus, the influence of permitless carry on smaller, more rural areas may not be represented in our findings.

Second, while we obtained multiple data sources to address validity concerns presented by other scholars (see Manski & Pepper, 2018), additional data should be included. Analyzed ShotSpotter data only included two cities, Toledo and Columbus, while multiple cities in our sample used this technology. Obtaining gunshot technology statistics for the other cities may provide a more accurate depiction of how the PCL may have had an impact on rates of ShotSpotter incidents, a tactic used by law enforcement to counteract gun violence. Further, while we had complete crime data for each city of interest, the Ohio Incident-Based Reporting System (OIBRS) was only able to provide researchers crime data for five of our cities of interest. As a result, crime data for the remaining cities were derived from alternative sources. This in turn, while accounted for to the best of our ability, may result in inconsistencies between cities considering that each city may report their crime data differently than OIBRS.

Lastly, the impact of other factors such as seasonality on the observed findings should be considered. Szkola et al. (2021) argued that considering people's routine activities is crucial to accurately examine the impact of crime. They suggested that, simply put, people's routine activities change in different seasons. During holidays and warmer seasons, an increasing number of people are out. In turn, this leads to an increase in suitable targets and motivated offenders. The impact of routine activities and seasonality may have affected some of the trends observed in our exploratory study. Szkola et al. cautioned areas affected by this influence may result in ineffective police practices when responding to crime.

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