



Interpersonal Firearm Injury and Death in Portland, Oregon: 2018 Through 2021

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Abstract

The annual number of firearm injuries in Portland, Oregon has been higher in the years since 2020 than in any prior year in the city's history. This descriptive study analyzed data from Gun Violence Archives (GVA) from January 1, 2018, to December 31, 2021. All incidents in GVA of interpersonal firearm injury that occurred in Portland during this period were analyzed for location, number of people injured or killed, and demographic information for those injured or killed. Comparisons in firearm injury rates were made with Seattle and San Francisco. Interpersonal firearm injuries began to rise after the first COVID-19 case in Oregon; July 2020 had the most injuries in the four-year period. Black men suffered the highest rate of interpersonal fatalities, with more than 11-fold higher rate per 100,000 than White men in every year studied. Portland had a higher rate of total interpersonal firearm injuries and a higher rate of firearm fatalities from 2018 through 2021 compared to Seattle and San Francisco. Neighborhoods near Downtown and those on the Eastside of the city had the highest rates of interpersonal injuries and deaths from firearms, whereas those in the Southwest had the lowest. Defining the burden of disease from interpersonal firearm injuries is a fundamental step in designing future public health research and implementing interventions to curb the trauma brought by interpersonal firearm injury.

Keywords Interpersonal firearm injury · Portland · Oregon · COVID-19 pandemic

Introduction

The number of interpersonal firearm injuries has been rising in major cities across the United States for the last five years, with a marked increase since the COVID-19 pandemic started in 2020 [1]. The pandemic amplified many of the psychosocial stresses that have been previously identified as risk factors for gun violence, such as income disparity, low

educational attainment, unemployment, and substance use [2]. This combined with a rise in firearm purchasing after the start of the pandemic [3] likely led to the observed upsurge in firearm injuries. A study at Boston Medical Center during the first year of the pandemic showed that unemployed men made up the largest portion of victims of violent penetrating injuries, and that the increase in penetrating injuries was isolated to firearms, with no increase in stabbing wounds [4].

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Additionally, the trauma from interpersonal firearm injuries disproportionately affects young men of color. In a cross-sectional study published in 2019, Black people had six-time higher potential life loss from firearm injuries than White people [5].

In Portland, Oregon the number of firearm-related arrests increased more than 200% from 2019 to 2020 [6]. In 2021, the number of all firearm injuries reported by the Police Bureau was higher than any other year in the city's history [6]. There has been no population-level study on interpersonal firearm violence specifically focused on Portland, Oregon, and that includes data covering the pandemic years. This study describes trends in interpersonal firearm-associated injuries and deaths in Portland to identify the demographics of those injured, where firearm injuries occur, and how these factors changed over the period between 2018 and 2021. The goal of this research is to develop hypotheses for future research focused on socio-economic, geographic, and demographic factors influencing notable rises in morbidity and mortality due to interpersonal firearm injuries over a relatively short period of time.

Methods

Data Collection

This descriptive study investigates the distribution and patterns of interpersonal firearm injuries in Portland, Oregon from January 1, 2018, to December 31, 2021. Gun Violence Archives (GVA) served as the primary data source [7]. GVA is an independent, non-profit organization that compiles data on incidents of gun violence throughout the United States and makes them available for research purposes. Data are obtained from over 7,500 government, law enforcement, social media, and news sources. Each incident undergoes primary and secondary confirmation by GVA researchers to ensure validity [7]. Data on date, location (address block and geolocation), and number injured and killed in the city of Portland were pulled manually from the GVA website for each month of the study period. Primary source links were explored to obtain additional data such as age, sex, and race of those injured or killed. Geocodes were used to map incidents to neighborhoods. Per University of Washington policy, no institutional review board (IRB) was required because only publicly available data were used.

All incidents that involved interpersonal violence, including those involving law enforcement interventions, were included in the study; 26 incidents where the injury was from personal harm or unintentional injury and 13 that occurred in the suburbs of Portland were excluded. To provide context for the number of interpersonal firearm injuries in Portland, we compared the interpersonal firearm injuries from GVA that occurred in Seattle, Washington and San Francisco, California during the same years. Seattle and San Francisco were chosen

because like Portland, they are major West Coast cities with populations between 650,000 and 900,000, and with a small population of Black individuals, less than 7% in each city [8]. Self-inflicted and unintentional firearm injuries were excluded from the GVA data for Seattle and San Francisco.

Starting in 2019, the Portland Police Bureau (PPB) made data publicly available on shooting incident location, date and whether injuries occurred. This dataset was used to identify locations when missing from GVA. PPB does not make person-level data or the number of injuries or deaths available to the public. The 2020 United States Census Bureau [8] was used to ascertain population data, including total population by study year, as well as estimates of race and age distribution for each year. Geocodes identifying locations where each incident occurred were mapped to one of 94 distinct neighborhoods of Portland (recognized by established neighborhood associations).

Data Analysis

Data analysis was conducted using R programming language in R-Studio. Incidents involving fatal interpersonal injuries were analyzed separately from total incidents (which includes both non-fatal and fatal injuries). This was done because incidents with fatal injuries had more consistent person-level data than those that involved non-fatal injuries. Incidents were analyzed by month and year from January 1, 2018, to December 31, 2021. Counts and percentages of injuries and deaths that were associated with legal interventions were included in the total incident analysis, as were the number of mass shootings per year (defined as shootings involving three or more persons injured or killed) [9]. Rates of total and fatal interpersonal firearm injuries per 100,000 people were calculated using population by year for Portland, Seattle, and San Francisco, as well as by categories of race/ethnicity and age in Portland. The graphing feature in Microsoft Excel and R-Studio was used to display the analyzed data.

Counts of total injuries and deaths and rates per neighborhood were calculated by using population estimates from 2020 [10]. The simple features package in R was used to perform a spatial join between GPS coordinates from GVA data and neighborhood coalitions downloaded from the City of Portland Maps [11]. During spatial analysis, it was noted that some incident locations ($n = 18$) identified by GVA as being within Portland were outside the boundaries according to the City of Portland Maps. These incidents are included in the total data analysis and are illustrated outside Portland city boundary.

Results

A total of 521 interpersonal firearm injury incidents from GVA were analyzed. Of these, 71 involved multiple injuries or deaths (18 mass shootings), totaling 605 persons

injured or killed in the four-year study period. Non-fatal interpersonal injuries decreased from 2018 to 2019, then increased in 2020 and 2021. Fatal interpersonal injuries increased each year studied (Table 1). Figure 1 illustrates this trend by quarter, showing the step rise in non-fatal and fatal interpersonal firearm injuries starting in Quarter 2 of 2020 and remaining above 2018 and 2019 injury numbers

through Quarter 4 of 2021. July 2020 had the most interpersonal firearm injuries in the four years studied. The largest increase in the total number of interpersonal firearm injuries occurred between 2019 and 2020, increasing from 79 to 171. The largest increasing in fatal interpersonal firearm injuries occurred from 2020 to 2021, increasing from 35 to 73 people killed (Table 1). The interpersonal fatal injury rate increased

Table 1 Characteristics of non-fatal and fatal interpersonal firearm injuries by year in Portland, Oregon, 2018–2021

	2018	2019	2020	2021
Total injuries	100	79	171	254
Non-fatal, n (%)	76 (76%)	51 (64%)	136 (79%)	181 (71%)
Fatal, n (%)	24 (24%)	28 (35%)	35 (20%)	73 (28%)
Rate (per 100,000 population)	15.64	12.24	26.17	38.71
Non-fatal	11.26	7.90	20.81	27.58
Fatal	3.75	4.34	5.36	11.12
Officer involved, n (%) ^a	9 (9.0%)	7 (8.8%)	7 (4.1%)	10 (3.9%)
Number of mass shootings ^b	2	2	3	11

^aInjuries inflicted by law enforcement officers during legal intervention

^bThree or more people shot or killed [9]

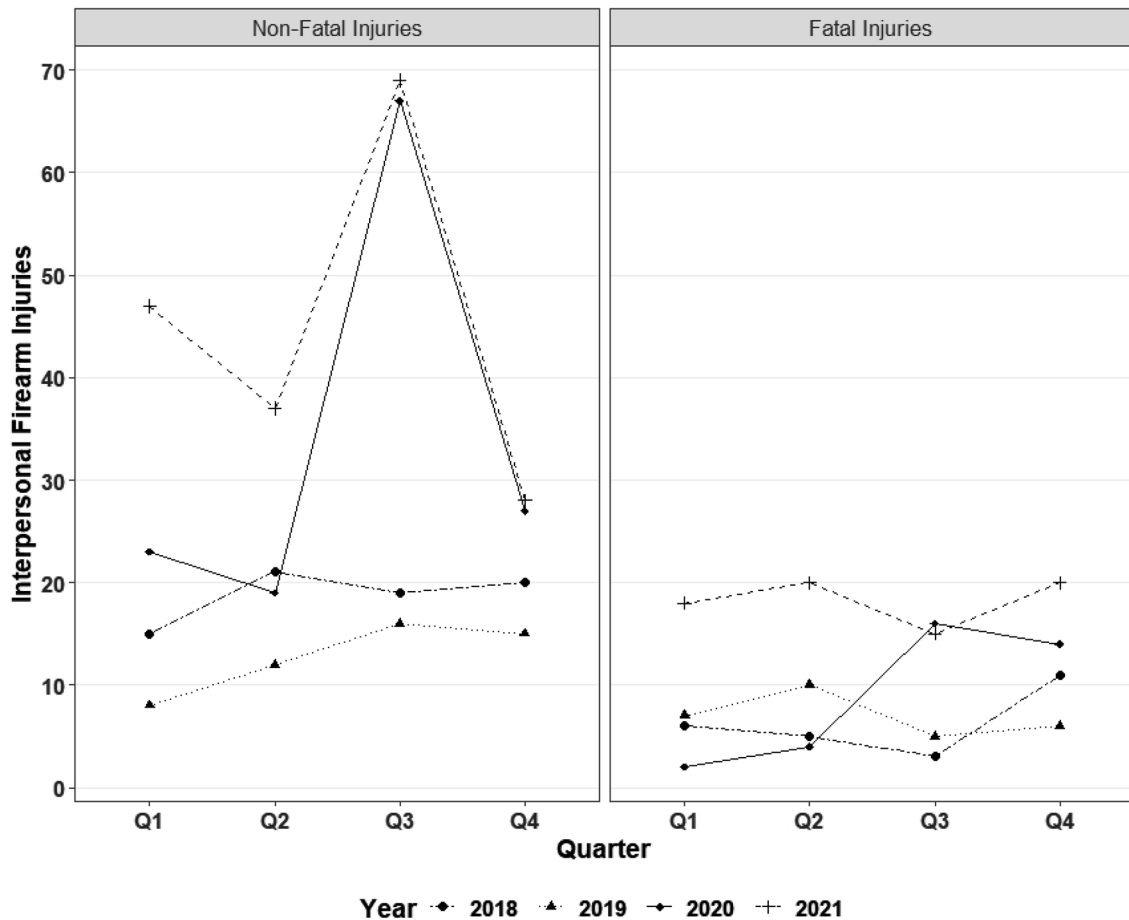


Fig. 1 Interpersonal firearm injuries in Portland, Oregon by Quarter and Year, 2018–2021

from 5.4 to 11.1 per 100,000 people from 2020 to 2021. The percentage of interpersonal firearm injuries (non-fatal and fatal) related to legal intervention was less than 10% each year. There were three or fewer mass shootings per year from 2018 through 2020; this more than quadrupled in 2021 to eleven incidents involving three or more people injured. There were two incidents in 2021 that involved more than five individuals, one in the Downtown neighborhood that involved seven (six injured, one killed) and another in the Madison South neighborhood that involved six individuals with two fatalities.

The fatal injury rate doubled from 2020 to 2021 (Table 2). Men sustained most fatal interpersonal injuries over the four-year period, comprising approximately 90% of deaths each year. In 2021, nine women were killed by firearms in Portland. While the numbers of fatal injuries among White people were roughly equal to those in Black people, the rates per 100,000 people were markedly higher for Black people (Table 2). Figure 2 shows that the rate of interpersonal fatal injuries was more than eleven times the rate for Black people

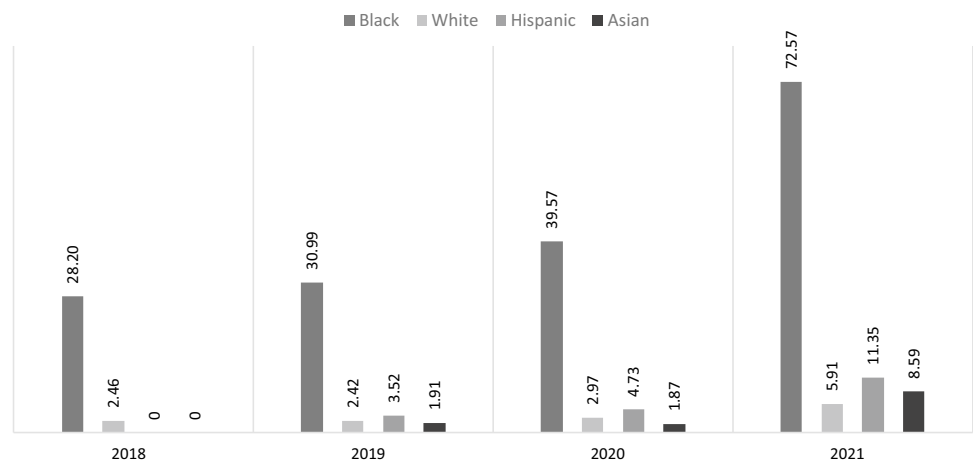
than for White people in each study year. Fatalities were 11.5-fold higher among Black than White people in 2018 (28.2 versus 2.5 per 100,000), 12.8-fold higher in 2019, 13.3-fold higher in 2020, and 12.3-fold higher in 2021. Fatalities among Asian and Hispanic people increased each year. Race/ethnicity was unknown in 6% of the fatal injuries analyzed.

In 2018 and 2019, Portland had rates of injuries and deaths from firearms similar to those of Seattle, Washington and San Francisco, California (Fig. 3). There was a greater increase in Portland of both fatal and non-fatal interpersonal firearm incidents in 2020 and 2021. In 2020, Portland had a rate of non-fatal interpersonal firearm injury of 20.8 per 100,000 people compared with 8.1 per 100,000 in Seattle and 9.9 per 100,000 in San Francisco. The non-fatal injury rate jumped in both Portland and Seattle in 2021, where the rate in San Francisco remained roughly the same. In Portland, the rate increased by 75% (from 20.8 to 27.6 per 100,000) and in Seattle it increased 81% (from 8.1 to 14.7 per 100,000). In 2021, the fatal injury rate in Portland was

Table 2 Fatal interpersonal firearm injury characteristics by year in Portland, Oregon, 2018–2021

Characteristic	2018	2019	2020	2021
Fatal injuries	24	28	35	73
Rate (per 100,000 population)	3.75	4.34	5.36	11.12
Sex, male, n (%)	22 (91.7%)	26 (92.9%)	32 (91.4%)	64 (87.7%)
Age, years (mean)	36.95	36.04	31.94	33.54
Officer involved, n (%)	3 (12.5%)	5 (17.9%)	1 (2.9%)	4 (5.5%)
Race/ethnicity				
White, n (%), rate	11 (45.8%), 2.46	11 (39.2%), 2.42	15 (42.8%), 2.97	28 (38.3%), 5.91
Black, n (%), rate	11 (45.8%), 28.20	11 (39.2%), 30.99	15 (42.8%), 39.57	30 (41.1%), 72.57
Hispanic, n (%), rate	0	2 (7.1%), 3.52	3 (9.3%), 4.73	7 (9.5%), 11.35
Asian, n (%), rate	0	1 (3.6%), 1.91	1 (2.8%), 1.87	4 (5.4%), 8.59
Unknown, n (%)	2 (8.3%)	3 (10.7%)	1 (2.8%)	4 (5.4%)

Fig. 2 Interpersonal fatal firearm injury rates per 100,000 by race and year, Portland, Oregon, 2018–2021



2.7 times that in the comparison cities (11.1 versus 4.2 and 4.1 in Seattle and San Francisco, respectively). Portland had a higher fatal firearm injury rate than both comparison cities in all years studied.

Sixty three of the 94 neighborhoods experienced one or more incidents of interpersonal firearm injury during the study period. The neighborhoods with the greatest number of interpersonal injuries were Hazelwood, Powellhurst-Gilbert, Old Town, Parkrose, and Downtown Portland. Old Town and Downtown are in the central area of the city, and Hazelwood, Powellhurst-Gilbert and Parkrose are on the East side. More than 20% of people in Old Town Community Association, Powellhurst-Gilbert and Portland Downtown have income below the federal poverty level, and all five neighborhoods have a median household income less than \$57,000 per year [10]. Figure 4 shows the map location of each incident where there was an interpersonal firearm injury in the four-year study period. One point may represent multiple injuries. Regionally, East Portland had the highest number of interpersonal firearm injuries, followed by Northwest, which includes Downtown and Old Town. The Southwest Neighborhood District had five total interpersonal firearm injury incidents in all four years studied. The neighborhoods that make up this region have low levels poverty [10]

Discussion

This study illustrates and characterizes a rapid rise in interpersonal firearm injuries in Portland starting after the beginning of the COVID-19 pandemic in 2020. It shows that Black men in Portland experience a consistent, markedly higher rate of interpersonal injuries and deaths from firearms than all other races and ethnicities. This study also shows that Portland's rate of interpersonal injuries and fatalities is higher than similar sized West Coast cities. The neighborhoods that experience the greatest burden of interpersonal firearm injuries are clustered in the East and Central areas of the city.

The first COVID-19 case was confirmed in Portland at the end of February 2020 and in mid-March Oregon initiated isolation measures, including closure of schools and non-essential businesses. The number of interpersonal firearm injuries declined during the first three months of the pandemic but rose steeply beginning in June 2020. George Floyd was murdered by a Minneapolis police officer on May 25, 2020, setting off protests nationwide, and which began occurring on a nightly basis in Portland starting on May 28, 2020. There were four incidents (one fatal) identified in GVA as directly related to racial justice protests. A rise in community tension from the racial justice reckoning, compounded by economic insecurity brought on by pandemic-related job loss, could have contributed to the rise of interpersonal firearm-related injuries that began in the summer of 2020.

The burden of interpersonal fatal firearm injuries that occurred in Portland from 2018 to 2021 predominantly affected men of color, with Black individuals dying at more

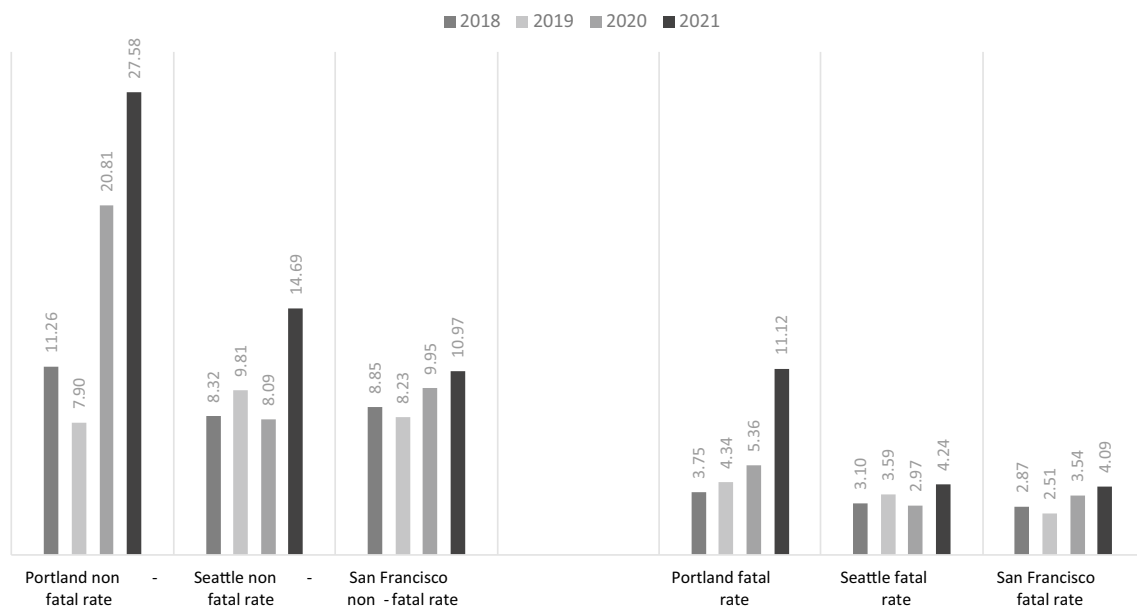


Fig. 3 Interpersonal firearm injury rates per 100,000, Portland, Seattle, and San Francisco, 2018–2021

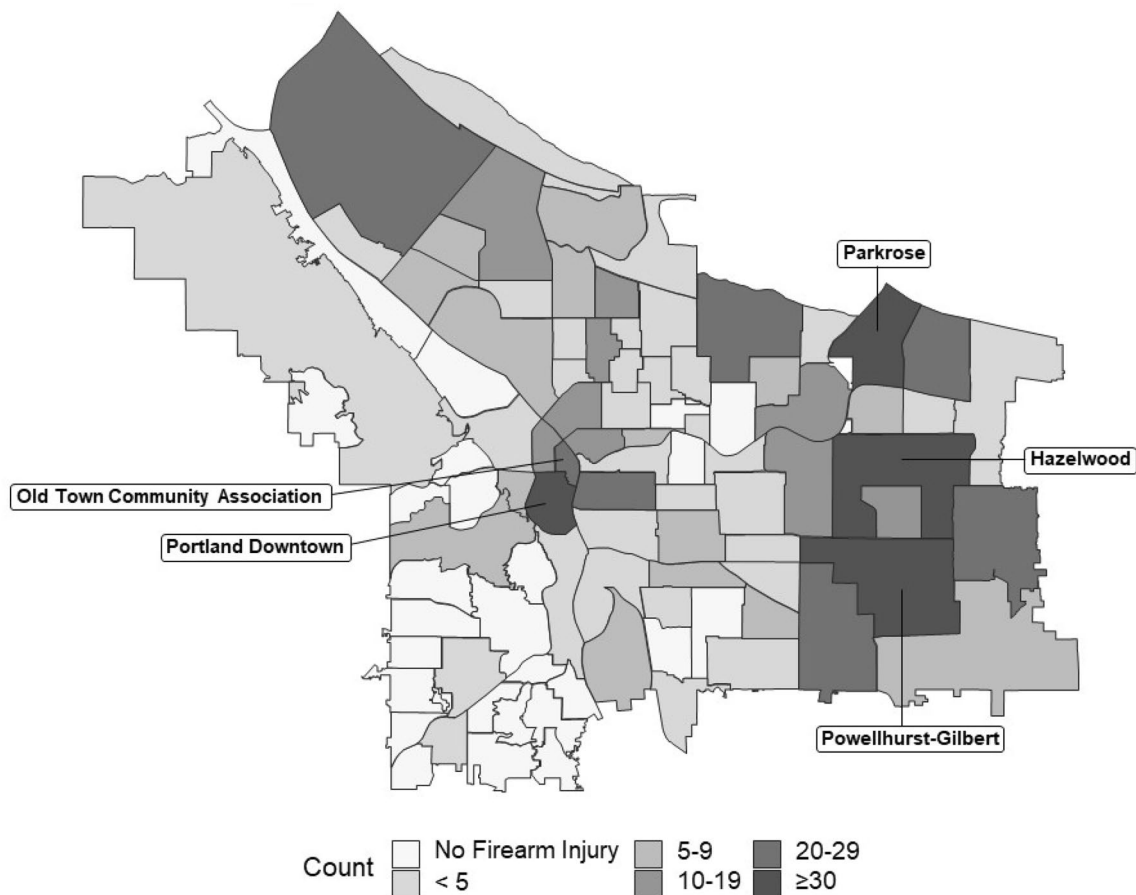


Fig. 4 Interpersonal firearm injuries (non-fatal and fatal) in Portland, Oregon by neighborhood, 2018–2021

than ten times the rate of White individuals. According to national data published by the Centers for Disease Control and Prevention [1], in 2020 the crude rate of homicide by firearm for Black individuals in the United States was 29.8 per 100,000. This study found that in Portland, Oregon the 2020 rate of firearm homicide among Black individuals was 39.6 per 100,000, 33% higher than the national rate. Although more recent data (2021 and later) are not yet available nationally, our study found that the rate of firearm homicides among Black individuals increased by 80% in Portland from 2020 to 2021. Previous studies have shown an association between rates of neighborhood firearm violence and racist practices such as redlining [12] and segregation in Northern cities [13]. Portland has a deep history of racist policies and discrimination that have led to persistent racial and ethnic inequality in the city [14]. A study from Portland State University in 2014 showed that not only do Black people in Portland trail behind White people economically and in health outcomes, but they also have lower socioeconomic stability than Black people in other similar sized cities [15]. It is imperative that Portland, as well as other cities experiencing the inequities caused by centuries of racist policies,

work to rectify the harms caused by these policies, including the exacerbation of interpersonal firearm violence. A notable finding from this study is the higher rate of interpersonal firearm injuries in Portland versus Seattle and San Francisco, especially fatal injuries. In addition to having similar population size and a low percentage of Black individuals, these West Coast cities are known nationally for progressive policies. Why Portland had more interpersonal firearm injuries during the study years with a greater rise after the start of the pandemic is likely multifactorial and worthy of further investigation. Examining racist social practices and ongoing displacement of oppressed people in these cities may lead to a better understanding of how systemic racism influences firearm violence in communities of color and help city officials develop an anti-racist approach to addressing it. Exploring the differences in the three city's police/medical response practices and state/local firearm policies could also shed light on why Portland has more firearm fatalities.

The number of firearm-associated interpersonal injuries were not equally distributed throughout Portland; certain neighborhoods were affected more, and the more highly impacted areas were clustered regionally. Although this

study did not examine formal associations, it is notable that the Southwest Neighborhood District, which has the highest median household income (\$99,000 per year [10]), had the fewest interpersonal firearm injuries, with no change from pre-pandemic to pandemic years. In contrast, the neighborhoods with the most interpersonal injuries have the lowest household income; the median income in Old Town Community Association, the neighborhood where the most firearm injuries occurred during the four years studied, is \$25,000 per household per year [10]. This finding is consistent with work from other urban centers identifying associations between poverty and high firearm homicide rates [16]. Recent studies have suggested however, that the spatial impact of firearm violence is not entirely explained by a community's disadvantage [17]. More research needs to be directed at understanding the risk factors that lead to neighborhood vulnerability to interpersonal firearm injuries.

The study has several limitations. First, Gun Violence Archives obtains information on firearm incidents by internet searches on news, social media, and local law enforcement databases. It does not utilize hospital data or collaborate with police bureaus, and thus may underestimate the number of interpersonal firearm injuries. Also, there was a discrepancy between what GVA identified as injury events in the city of Portland that were outside city boundaries when mapped. This occurred for 3% of the injury events analyzed. Incidents from GVA for Seattle and San Francisco were not spatially analyzed but can be assumed to have similar location variance. Finally, this study was of a single city during a discrete period; its generalizability to the firearm injury crisis occurring nationally or in other urban centers may be limited.

Since the completion of this study there have been more than 200 interpersonal firearm injuries in Portland from January 1 to September 30, 2022, with 75 fatalities [7], more than the number of fatal interpersonal firearm injuries in all of 2021. This study deepens the understanding of the continued rapid increase in interpersonal firearm injuries that has occurred in a short period of time in one city after the start of the COVID-19 pandemic. By analyzing the numbers of individuals affected, where the injuries are occurring and which populations are most impacted, we can better tailor future public health research and interventions. Additional research is needed to examine causes of, and potential solutions for, overall firearm violence as well as inequities in the burden of firearm violence in Portland and other urban centers across the nation.

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Declarations

Conflict of interest No author is involved in any personal or professional affiliations that pose a conflict of interest in the publication of this research.

Ethical Approval The project used only publicly available data and is therefore IRB exempt per University of Washington School of Public Health policy. This is original work which has not been previously published nor is being considered for publication elsewhere.

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