BMJ Open

Changing epidemiology of firearm injury: a cohort study of non-fatal firearm victimisation before and during the COVID-19 pandemic, Indianapolis, Indiana

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To cite: Magee LA, Lucas B, Fortenberry JD. Changing epidemiology of firearm injury: a cohort study of non-fatal firearm victimisation before and during the COVID-19 pandemic, Indianapolis, Indiana. *BMJ Open* 2022;**12**:e059315. doi:10.1136/bmjopen-2021-059315

► Prepublication history for this paper is available online. To view these files, please visit the journal online (http://dx.doi.org/10.1136/bmjopen-2021-059315).

Received 16 November 2021
Accepted 25 February 2022

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ABSTRACT

Objective To examine victimisation rates, geographic patterns and neighbourhood characteristics associated with non-fatal firearm injury rates before and during the COVID-19 pandemic.

Design A retrospective cohort study.

Setting City of Indianapolis, Indiana, USA, 1 January 2017–30 June 2021.

Participants Intentional non-fatal firearm injury victims from Indianapolis Metropolitan Police Department records. The study included information on 2578 non-fatal firearm injury victims between ages 0 and 77 years. Of these victims, 82.5% were male and 77.4% were black.

Primary and secondary outcome measures Rates of non-fatal firearm injuries per 100 000 population by victim age, race, sex and incident motive. Prepandemic and peripandemic non-fatal firearm injury rates.

Results Non-fatal shooting rates increased 8.60%, from 57.0 per 100 000 person-years in prepandemic years to 65.6 per 100 000 person-years during the pandemic (p<0.001). Rates of female victims (15.2 vs 23.8 per 100,000; p<0.001) and older victims (91.3 vs 120.4 per 100,000; p<0.001) increased significantly during the pandemic compared with the prepandemic period. Neighbourhoods with higher levels of structural disadvantage (IRR: 1.157, 95% CI 1.012 to 1.324) and prepandemic firearm injury rates (IRR: 1.001, 95% CI 1.001 to 1.002) was positively associated with higher rates of non-fatal firearm injuries during the pandemic, adjusting for neighbourhood characteristics.

Conclusions Non-fatal firearm injuries increased significantly during the COVID-19 pandemic, particularly among female and older victims. Efforts are needed to expand and rethink current firearm prevention efforts that both address the diversification of victimisation and the larger societal trauma of firearm violence.

Strengths and limitations of this study

- ► A study of non-fatal firearm injuries drawn from police records allows for a complete population-based cohort study of non-fatal firearm injury victims in a large US city.
- ► Leveraging police records of non-fatal firearm injuries allowed us to examine differences in victimisation rates by race, sex, age, incident motive and geographic patterns during the COVID-19 pandemic compared with prepandemic.
- ► Given the lack of non-fatal firearm injury data at the national level, we were unable to compare rate increases in female and older victims to other large cities.

INTRODUCTION

During the COVID-19 pandemic, many cities in the USA observed unprecedented increases in firearm injuries and rates continued to increase by as much as 16% during the first half of 2021.[1] Firearm injuries increased immediately following the onset of the pandemic,[2] non-fatal firearm injuries increased at higher rates than fatal firearm injuries,[3] and firearm injuries increased among young children as well.[4] Large increases in firearm purchasing and higher unemployment rates are associated with spikes in firearm injuries early in the pandemic.[5 6] The increase in firearm purchasing is also associated with increases in domestic-related firearm injuries during the onset of the pandemic.[5] Overall, higher rates of firearm ownership is associated with higher rates of firearm injuries.[7] Prior studies, however, are limited in their scope, as only a brief period of 2020 is included, or only aggregate national, state, or city-trends are examined, and victim demographics, motives behind the shooting and within-city neighbourhood variations are largely overlooked.

Non-fatal firearm injuries are well-established sources of health inequity. Non-fatal firearm injuries are four times more prevalent than fatal firearm injuries and approximately 85 694 non-fatal firearm

injuries occurring annually.[8] Non-fatal firearm injuries most often occur in structurally disadvantaged urban communities[9 10] and survivors of non-fatal shootings are disproportionately young black men between the ages of 15 and 29 years.[11] Survivors of non-fatal firearm injuries are more likely to suffer adverse health outcomes such as physical disabilities, chronic pain, post-traumatic stress disorder, depression and substance use.[12 13] Beyond non-fatal injury survivors, a growing body of research suggests exposure (both direct and indirect) to fatal and non-fatal firearm injuries increases adverse health outcomes, such as worse mental health outcomes for residents.[14 15] Community rates of non-fatal firearm injuries are associated with higher levels of obesity, smoking, lack of sleep, physical inactivity and higher levels of disability at the community level, compared with fatal firearm injuries.[16 17] These findings speak to the unique dynamics of non-fatal firearm injuries and how community non-fatal firearm injuries rates contribute to health disparities and health inequities within our society. The COVID-19 pandemic added new stresses to many already struggling communities, with increased rates of infections and deaths, reduced access to services and increased potentials for conflict during periods of stricter quarantine.[18] Therefore, the combination of pandemic-related stressors and greater firearm availability may expand the epidemiology of non-fatal firearm injury rates, consequently diffusing its health-related disparities to broader communities.

Indianapolis, Indiana, is one of the cities that experienced an increase in non-fatal firearm injuries and was the 11th most violent US city in 2020 according to Federal Bureau of Investigation Uniform Crime Reports.[1] Given the established prevalence of non-fatal firearm injuries versus fatal shootings and limited research focused on the epidemiology of non-fatal firearm injury victims during the COVID-19 pandemic, this study uses official police records combined with multiple data sources to examine victimisation rates, geographic patterns and neighbourhood characteristics of non-fatal shooting rates before and during the first 18 months of the COVID-19 pandemic. We must first determine if the epidemiology of firearm injury survivors has changed postpandemic onset in order to recognise new health disparities highlighted by the COVID-19 pandemic and better inform public health responses for firearm injury survivors and communities.

METHODS

Study design and measures

This is a retrospective cohort study of non-fatal firearm injuries from 1 January 2017 to 30 June 2021. Study data come from Indianapolis (Marion County), Indiana, the largest county in the state. In 2019, the population of Indianapolis was estimated at 874 005 and is 53% white, 28% black, 11% Hispanic or Latino and 4% Asian.[19] Data were obtained from the Indianapolis Metropolitan Police Department (IMPD), the Indianapolis Open Data Portal and the US Census Bureau. We followed the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines. The Indiana University Institutional Review Board determined this study exempt.

Measures

Data on non-fatal firearm injuries were obtained from IMPD. Due to mandatory reporting laws,[20] police records provide more complete records compared with clinical data.[21] A non-fatal firearm injury is defined as an assault in which a projectile weapon with a powder discharge causes a penetrating injury.[22] All self-inflicted and police-involved shootings are excluded from this study. Data include victim demographics, incident location, incident date and incident motive.

Victim race/ethnicity (white, black, other), sex and age at time of incident were used as recorded by IMPD reports. Age categories were defined as: 0–14, 15–17, 18–20, 21–24, 25–29, 30–34 and ≥35 years. Incident motives provide context to the shooting event and were classified as illegal activity (eg, robbery and drugs), interpersonal dispute (eg, argument and fight), bystander (eg, drive-by and untended target), domestic violence, money/other and unknown.[23]

Census tract characteristics were defined based on incident location using US census data. Using factor analysis, the per cent of residents living in poverty, per cent single female headed households and per cent unemployed were combined as a measure of structural disadvantage.[24] All measures loaded with factor scores above 0.8. Other measures included the per cent of black residents, per cent of Hispanic residents, per cent of residents with a high school diploma, per cent of disability and total population per census tract based on prior studies.[17] The number of abandoned homes were obtained from the Indianapolis open data portal (data.indy.gov) was divided into quartiles and included as a binary measure of the highest quartile versus all others.[10]

Patient and public involvement

Patients and/or the public were not involved in the design, analysis, reporting or dissemination plans of this research.

Geocoding

Addresses from non-fatal firearm injuries were geocoded to street location using ArcGIS V.10.8 and Marion County base maps. Of the non-fatal firearm injuries (n=2578), 96% (n=2478) were successfully geocoded, geotagged and aggregated to their associated census tracts. Incidents that did not geocode (n=100) contained missing address information or unknown incident locations.

Analysis

We compared characteristics of non-fatal firearm injury victims during the prepandemic period (2017–February 2020) with those of non-fatal shooting victims during the COVID-19 pandemic (March 2020–June 2021). Across characteristics, we calculated the rate per 100 000

person-years, and the absolute and percentage rate changes between observation periods. Rates calculated for sex, age and race were adjusted estimated population size; incident motive rates used total population adjusted for the number of years in the pre–post COVID-19 period. We assessed differences across pre–post COVID-19 periods using χ^2 and Fisher's exact tests at statistical significance level of p<0.05.

To assess differences in neighbourhood characteristics on non-fatal firearm injuries before and during the pandemic, three multivariate models were assessed. Because nearly a quarter of census tracts did not experience a non-fatal firearm injury, a zero-inflated negative binomial regression model was conducted. To estimate the excess zeros, the total population was included. Prepandemic and peripandemic non-fatal firearm injury rates were modelled as a function of neighbourhood characteristics, and the incident rate ratios (IRRs) were estimated for each neighbourhood characteristics. A Bayesian information criterion (BIC) and Akaike information criterion (AIC) were included to measure model fit. Data were analysed in October of 2021 using Stata Version 16.

RESULTS

A total of 2578 non-fatal firearm injuries occurred during our study period. Victims were predominately men (n=2128 (83%)) and black (n=1,995 (77%)), with a mean age of 29.9 years (SD: 11.8). The rate of non-fatal firearm injuries increased 8.60%, from 57.0 per 100 000 person-years in prepandemic years to 65.6 per 100 000 person-years during the first 18 months of the pandemic (p<0.001). The rate of male victims (91.1 vs 97.9 per 100 000; p<0.001) and black victims (144.5 vs 166.6 per 100 000; p<0.001) increased significantly during the pandemic months. Non-fatal shooting rates increased substantially for female victims (15.2 vs 23.8 per 100,000; p<0.001) and for non-black victims (18.5 vs 21.3 per 100 000; p<0.001) during the pandemic compared with the prepandemic period. Non-fatal firearm injuries rates of victims under age 21 years increased among groups less than 15 years (5.76 vs 6.14 per 100 000; p<0.001, those, 15–17 years (72.9 vs 77.7 per 100 000; p<0.001) and among those 18–20 years (185.6 vs 201.9 per 100 000; p<0.001) during the pandemic compared with prepandemic period. Victims over 21 years of age significantly increased during the pandemic (21–24 years: 158.1 vs 165.4 per 100,000; p<0.001; 25–29 years: 103.1 vs 118.0 per 100 000; p<0.001; ≥35 years: 29.6 vs 36.3 per 100 000; p<0.001, with the largest increase of 32% observed for victims between 30 and 34 years of age (91.3 vs 120.4 per 100 000; p<0.001), compared with the prepandemic period (table 1).

When shooting motive was known, illegal activity (14.4 vs 11.8 per 100 000; p<0.001) and domestic violence (1.82 vs 1.75 per 100 000; p<0.001) slightly decreased during the pandemic. Being a bystander (4.23 vs 6.22 per 100 000; p<0.001), money/other (2.70 vs 3.11 per 100 000; p<0.001) and interpersonal disputes (15.2 vs 17.5 per 100,000; p<0.001) significantly increased during the pandemic compared with the prepandemic period (table 1).

We conducted multivariate models comparing neighbourhood characteristics on prepandemic non-fatal firearm injury rates and during the pandemic non-fatal firearm injury rates (table 2). Higher rates of neighbourhood structural disadvantage (prepandemic—IRR: 1.407, 95% CI 1.219 to 1.644 vs during pandemic—IRR, 1.280, 95% CI 1.110 to 1.476) abandoned homes (prepandemic—IRR: 2.113, 95% CI 1.681 to 2.656 vs during pandemic—IRR, 1.960, 95% CI 1.523 to 2.522) and neighbourhoods with residents who primarily identify as black (prepandemic—IRR: 1.014, 95% CI 1.009 to 1.019 vs during pandemic—IRR, 1.011, 95% CI 1.005 to 1.015) are associated with higher non-fatal firearm injury rates prepandemic and during the pandemic. Prepandemic neighbourhood non-fatal shooting rates predicted higher (IRR 1.001, 95% CI 1.001 to 1.002) neighbourhood non-fatal firearm injury rates during the pandemic, when adjusting for all other neighbourhood characteristics. The AIC and BIC indicate better model fit in the final model.

DISCUSSION

This study compared the trends and geographic patterns of non-fatal firearm injuries during the COVID-19 pandemic compared with the prepandemic period. Our results demonstrate three important findings about non-fatal firearm injuries during the pandemic: (1) the rate of non-fatal firearm injuries increased by 9% compared with prepandemic, (2) there were substantial increases in the rate of female and older victims and (3) non-fatal firearm injuries continued to be most prevalent within neighbourhoods with higher rates of prepandemic firearm injuries, structural disadvantage and structural racism. The increase in non-fatal firearm injuries during the pandemic is consistent with trends in national data.[25 26]

Most notably, the rate of female non-fatal firearm injury victims doubled during the pandemic period compared with prepandemic. Prior studies suggest an increase in intimate partner violence during the pandemic,[27] however, our findings demonstrate a decrease in domestic violence. This key finding may speak to the changing nature of gun violence, specifically for female victims during the pandemic. Our findings also highlight increases across all age groups, with the most notable increase in older victims. Non-fatal firearm injury victims 30 years of age and older experienced the largest rate increase during the first 18 months of the pandemic, with older victims accounting for nearly half of all non-fatal firearm injury victims. Pandemic-related stressors such as unemployment, financial strain, increased unscheduled time, social isolation and the increase in access to firearms are associated with increases in firearm injuries and it is plausible such factors help explain the noted increases in

Table 1 Count, incidence rate and rate change of non-fatal firearm injury victimisation in Indianapolis, Indiana, January 1, 2017–June 30, 2021

	Individuals, number (%)					Rate, per 100 000			
Characteristic	2017	2018	2019	2020	January–June 2021	Pre-COVID-19 (2017–February 2020)	During COVID-19 (March 2020–June 2021	Absolute rate change, pre/during COVID-19	Change in rate pre/post, %
N	486	484	524	706	378	**57.0**	**65.6**	8.60	15.1
Race									
Black	379	377	410	536	293	**144.5**	**166.6**	22.2	15.3
Non-Black	102	107	112	170	83	**18.5**	**21.3**	2.86	15.1
Sex									
Male	418	413	438	553	306	**91.1**	**97.9**	6.85	7.46
Female	68	71	85	153	71	**15.2**	**23.8**	8.63	56.6
Age group, y									
<15	9	11	15	14	7	**5.76**	**6.14**	0.38	6.60
15–17	29	22	31	38	16	**72.9**	**77.7**	4.85	6.58
18–20	67	74	84	99	50	**185.6**	**201.9**	16.4	8.78
21–24	76	94	86	112	64	**158.1**	**165.4**	7.23	4.62
25–29	98	89	81	138	56	**103.1**	**118.0**	14.9	14.5
30–34	82	67	58	111	60	**91.3**	**120.4**	29.1	31.9
≥35	125	127	169	194	125	**29.6**	**35.3**	5.69	19.3
Motive									
Unknown	161	167	161	242	173	**18.7**	**25.3**	6.53	35.3
Illegal activity	126	143	106	148	54	**14.4**	**11.8**	–2.60	–18.1
Interpersonal dispute	126	101	172	188	99	**15.2**	**17.5**	2.33	15.1
Bystander	40	38	38	67	29	**4.23**	**6.22**	1.99	47.0
Domestic violence	15	15	17	23	7	**1.82**	**1.75**	–0.07	–3.85
Money/other	18	20	30	38	16	**2.70**	**3.11**	0.41	15.2

Bolded values indicate p=0.001.

both female and older victims.[6 18] Our findings also note a particularly high increase in shootings motivated by interpersonal disputes, which would support the notion of a shift in victim demographics—particularly among female and older victims—when pandemic-related stressors and greater access to firearms facilitates conflicts that are

Table 2 Incident rate ratios of non-fatal firearm injury rates by census tract characteristics, Indianapolis, Indiana

	Model 1	Model 2	Model 3
	Pre-COVID-19 NFS rate	During COVID-19 NFS rate	During COVID-19 NFS rate
	IRR (95% CI)	IRR (95% CI)	IRR (95% CI)
Pre-COVID-19 NFS rates	–	–	**1.001 (1.001 to 1.002)**
Structural disadvantage	**1.407 (1.219 to 1.644)**	**1.280 (1.110 to 1.476)**	**1.157 (1.012 to 1.324)**
% Black	**1.014 (1.009 to 1.019)**	**1.011 (1.005 to 1.015)**	**1.005 (1.001 to 1.010)**
% Hispanic	**1.017 (1.006 to 1.028)**	1.005 (0.994 to 1.018)	1.004 (0.994 to 1.015)
% High school diploma	1.015 (0.999 to 1.031)	1.006 (0.991 to 1.021)	0.999 (0.987 to 1.012)
% Disability	1.017 (0.991 to 1.043)	1.013 (0.992 to 1.035)	1.008 (0.993 to 1.024)
Abandoned homes	**2.113 (1.681 to 2.656)**	**1.960 (1.523 to 2.522)**	**1.504 (1.173 to 1.927)**
AIC	2362.08	2157.99	2133.99
BIC	2395.83	2191.74	2171.12

Bolded values indicate p<0.05.
AIC, Akaike information criterion; BIC, Bayesian information criterion; IRR, incident rate ratios; NFS, non-fatal shooting.

handled with a firearm. Our findings also note a slight increase in paediatric non-fatal firearm injuries and victims between 21 and 24 years of age, which are well-documented groups at risk, however, our findings indicate that these age groups are not driving the pandemic increase in firearm violence.[4 28]

Finally, our findings indicate higher rates of non-fatal firearm injuries continue to occur in structurally disadvantaged communities, further contributing to health disparities in communities that have experienced structural disadvantage and racial inequalities for decades.[26 29] A growing body of research demonstrates levels of community firearm violence not only impacts the victim but contributes to higher levels of resident disability, adverse health outcomes and mental health needs among adults and children who are indirectly impacted by the continued trauma of firearm violence.[15–17] Disadvantaged communities often lack available healthcare or post-hospital care is difficult for victims to obtain,[30] leaving victims and communities to cope with the trauma of their injuries alone, consequently compounding inequalities. Therefore, it is imperative to view and address community firearm violence as a public health crisis that needs to address the health of all residents within communities most impacted by firearm violence, not just the victims.

To prevent firearm violence through a public health approach, it is essential to understand the epidemiology of non-fatal firearm injury victims in order to design prevention efforts by identifying individuals and communities most affected by non-fatal firearm violence.[31] This study highlights three critical avenues to prevent future firearm violence and improve the health of those directly and indirectly impacted by non-fatal firearm injuries. One, our findings clearly demonstrate victimisation rates of non-fatal firearm injuries have shifted during the first 18 months the COVID-19 pandemic with higher rates of female and older victims. Current programmes focused on providing services to female victims of domestic violence exist, however, our findings suggest that the increase in female victims is not driven by domestic-related violence but interpersonal violence. Violence prevention programmes such as Hospital Based Violence Intervention Programs (HVIPs), Cure Violence and other community programmes seek to connect victims of interpersonal violence to needed financial, health, legal or other needed services postinjury. Most HVIPs and other community-based programmes, such as Cure Violence, which uses violence interpreters to mediate conflicts before they escalate to violence are largely focused on adolescents and young adults and reducing retalitation.[32] Programmes should expand resources and outreach to meet the needs of female victims, for example, hiring more female violence interpreters who may better relate to the needs of female victims involved in interpersonal disputes. Much less is known about older victims of non-fatal firearm injuries, as research typically focuses on paediatric and young adult victims. Older victims may suffer more adverse health outcomes, such as mental illness and other chronic conditions,[33] and may have experienced more cumulative trauma and, therefore, respond differently to the emotional and physical trauma of their injury.[34] Older adults are more likely to be connected with a primary care provider, whom should use this opportunity to connect victims with mental health services.[35] Post-hospital discharge care programmes provide ongoing mental health services outside of the managed care system and follows up weekly with patients[36] and demonstrates an increase in mental health utilisation among paediatric patients. Such a programme should expand outreach to all victims, particularly female and older victims, to better connect them with needed services postinjury. Additionally, collaborations and partnerships between firearm prevention programmes, community organisations and other city organisations are crucial to expand resources to address food insecurity, housing insecurity, socioeconomic insecurity and other community health needs most impacted by the continued high rates of non-fatal firearm injuries.

Second, our findings demonstrate communities with more abandoned homes experience higher rates of non-fatal firearm injuries. Efforts to eliminate and demolish abandoned homes have reduced firearm violence by 11% in Detroit, Michigan and other community greening projects have reduced gun assaults and overall community violence.[37] Improving the maintenance of vacant lots through community greening projects also reduces residents fear of crime and improves overall community mental health outcomes.[38]

Finally, these findings speak to the need for nationally available data on non-fatal firearm injuries to examine trends and patterns in victimisation rates. Given the lack of available data, many have used the publicly available data set compiled by the Gun Violence Archive. These data, however, are a collection of media reports that have demonstrated to be an undercount of official records by nearly half.[39] Additionally, nationally available non-fatal firearm injury data would allow for linkage with other national healthcare data to examine long-term health outcomes of those directly and indirectly affected by firearm violence.[40]

Limitations

There are several limitations of this study that should be noted. First, these results only include one jurisdiction. However, our data provide victim demographics and incident motive which are not typically available at the national level. Given mandatory reporting laws to law enforcement, our use of police data includes all victims of non-fatal firearm injuries that presented for care at an emergency room or reported their injury to police; however, these data do not include self-inflicted injuries, police-involved shootings or injuries not reported to the police. This study is only descriptive, and results cannot speak to causation. Nonetheless, the findings of this study expand our current understanding of victims of firearm violence and provide direction for future studies into

the increase of firearm violence during the COVID-19 pandemic.

CONCLUSION

Our study demonstrated an overall increase in non-fatal firearm injuries, shifting demographics of victims—particularly female and older victims, and that non-fatal firearm injuries during the pandemic continue to occur within structural disadvantaged communities that have experienced health and racial inequities for decades. These findings support the need to expand and rethink current firearm prevention efforts that both address the diversification of victimisation, and how to address the health needs of residents within communities that experience the daily trauma of firearm violence.

Acknowledgements The authors wish to thank the Indianapolis Metropolitan Police Department for access to the data and their continued partnership.

Contributors LAM developed the research question, obtained, analysed the data, wrote the manuscript, and is responsible for the overall content as the guarantor. BL and JDF helped with interpretation of results. All authors contributed to the writing and editing of the manuscript. All authors read and approved the final manuscript.

Funding LAM was supported by KL2 funding support from Grant Numbers, KL2TR002530 (B. Tucker Edmonds, PI), and UL1TR002529 (S. Moe and S. Wiehe, co-PIs) from the National Institutes of Health, National Center for Advancing Translational Sciences, Clinical and Translational Sciences Award.

Competing interests None declared.

Patient and public involvement Patients and/or the public were not involved in the design, or conduct, or reporting, or dissemination plans of this research.

Patient consent for publication Not applicable.

Ethics approval The Indiana University institutional review board determined this study exempt (#10809).

Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement Data may be obtained from a third party and are not publicly available.

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REFERENCES

1 Rosenfeld RL. *Pandemic, Social Unrest, and Crime in U.S. Cities:*. Washington, DC: Council on Criminal Justice, July, 2021.
2 Beard JH, Jacoby SF, Maher Z, *et al*. Changes in shooting incidence in Philadelphia, Pennsylvania, between March and November 2020. *JAMA* 2021;325:1327.
3 Kim D-Y, Phillips SW. When COVID-19 and guns meet: a rise in shootings. *J Crim Justice* 2021;73:101783.
4 Cohen JS, Donnelly K, Patel SJ, *et al*. Firearms injuries involving young children in the United States during the COVID-19 pandemic. *Pediatrics* 2021;148.
5 Schleimer JP, McCort CD, Pear VA. Firearm purchasing and firearm violence in the first months of the coronavirus pandemic in the United States. *MedRxiv* 2020.
6 Schleimer JP, Pear VA, McCort CD. Unemployment and crime in US cities during the coronavirus pandemic. *J Urban Health* 2022:1–10.
7 Siegel M, Ross CS, King C, King III C. The relationship between gun ownership and firearm homicide rates in the United States, 1981–2010. *Am J Public Health* 2013;103:2098–105.
8 Kaufman EJ, Wiebe DJ, Xiong RA, *et al*. Epidemiologic trends in fatal and nonfatal firearm injuries in the US, 2009-2017. *JAMA Intern Med* 2021;181:237–44.
9 Braga AA, Papachristos AV, Hureau DM. The concentration and stability of gun violence at micro places in Boston, 1980–2008. *J Quant Criminol* 2010;26:33–53.
10 Magee LA. Community-Level social processes and firearm shooting events: a multilevel analysis. *J Urban Health* 2020;97:296–305.
11 Kalesan B, French C, Fagan JA, *et al*. Firearm-Related hospitalizations and in-hospital mortality in the United States, 2000-2010. *Am J Epidemiol* 2014;179:303–12.
12 Lee J. Wounded: life after the shooting. *Ann Am Acad Political Soc Sci* 2012;642:244–57.
13 Raza S, Thiruchelvam D, Redelmeier DA. Death and long-term disability after gun injury: a cohort analysis. *CMAJ Open* 2020;8:E469–78.
14 Leibbrand C, Hill H, Rowhani-Rahbar A. Invisible wounds: Community exposure to gun homicides and adolescents' mental health and behavioral outcomes. *SSM Popul Health* 2020;12.
15 Vasan A, Mitchell HK, Fein JA, *et al*. Association of neighborhood gun violence with mental Health–Related pediatric emergency department utilization. *JAMA Pediatr* 2021;175:1244.
16 Semenza DC, Stansfield R. Non-Fatal gun violence and community health behaviors: a neighborhood analysis in Philadelphia. *J Behav Med* 2021;44:833–41.
17 Semenza DC, Stansfield R. Community gun violence and functional disability: an ecological analysis among men in four U.S. cities. *Health Place* 2021;70:102625.
18 Neufeld MY, Poulson M, Stolarski AE. Amplifying inequity: the compounding impact of COVID-19 and violence. *J Natl Med Assoc* 2021;113:520–30.
19 Bureau USC. American community survey 1-year estimates. retrieved from census reporter profile page for Indianapolis City (balance), in, 2019. Available: http://censusreporter.org/profiles/16000US1836003-indianapolis-city-balance-in/
20 Gupta M. Mandatory reporting laws and the emergency physician. *Ann Emerg Med* 2007;49:369–76.
21 Magee LA, Ranney ML, Fortenberry JD, *et al*. Identifying nonfatal firearm assault incidents through linking police data and clinical records: cohort study in Indianapolis, Indiana, 2007–2016. *Prev Med* 2021;149:106605.
22 Beaman V, Annest JL, Mercy JA, *et al*. Lethality of firearm-related injuries in the United States population. *Ann Emerg Med* 2000;35:258–66.
23 Kaufman EJ, Wiebe DJ, Xiong RA, *et al*. Epidemiologic trends in fatal and nonfatal firearm injuries in the US, 2009-2017. *JAMA Intern Med* 2021;181:237-244.
24 Sampson RJ, Sharkey P, Raudenbush SW. Durable effects of concentrated disadvantage on verbal ability among African-American children. *Proc Natl Acad Sci U S A* 2008;105:845–52.
25 Ssentongo P, Fronterre C, Ssentongo AE, *et al*. Gun violence incidence during the COVID-19 pandemic is higher than before the pandemic in the United States. *Sci Rep* 2021;11:1–8.
26 Schleimer JP, Buggs SA, McCort CD, *et al*. Neighborhood racial and economic segregation and disparities in violence during the CoViD-19 pandemic. *Am J Public Health* 2022;112:144–53.
27 Mohler G, Bertozzi AL, Carter J, *et al*. Impact of social distancing during COVID-19 pandemic on crime in Los Angeles and Indianapolis. *J Crim Justice* 2020;68:101692.
28 Donnelly MR, Grigorian A, Swentek L, *et al*. Firearm violence against children in the United States: trends in the wake of the COVID-19 pandemic. *J Trauma Acute Care Surg* 2022;92:65–8.
29 Jacoby SF, Dong B, Beard JH, *et al*. The enduring impact of historical and structural racism on urban violence in Philadelphia. *Soc Sci Med* 2018;199:87–95.
30 Patton D, Sodhi A, Affinati S, *et al*. Post-Discharge needs of victims of gun violence in Chicago: a qualitative study. *J Interpers Violence* 2019;34:135–55.
31 Goldstick JE, Carter PM, Cunningham RM. Current epidemiological trends in firearm mortality in the United States. *JAMA Psychiatry* 2021;78:241–2.
32 Affinati S, Patton D, Hansen L, *et al*. Hospital-Based violence intervention programs targeting adult populations: an eastern association for the surgery of trauma evidence-based review. *Trauma Surg Acute Care Open* 2016;1:e000024.
33 Maccarrone J, Stripling A, Iannucci J, *et al*. Exposure to trauma, PTSD and persistent pain in older adults: a systematic review. *Aggress Violent Behav* 2021;57:101488.
34 Atwoli L, Platt JM, Basu A, *et al*. Associations between lifetime potentially traumatic events and chronic physical conditions in the South African stress and health survey: a cross-sectional study. *BMC Psychiatry* 2016;16:1–10.

35 Rosen T, Makaroun LK, Conwell Y, *et al*. Violence in older adults: scope, impact, challenges, and strategies for prevention. *Health Aff* 2019;38:1630–7.
36 Neufeld MY, Janeway MG, Lee SY, *et al*. Utilization of mental health services in pediatric patients surviving penetrating trauma resulting from interpersonal violence. *Am J Surg* 2021;221:233–9.
37 Jay J, Miratrix LW, Branas CC. Firearm violence and drug crime. *J Behav Med* 2019;42:626–34.
38 Burt CJ, Kondo MC, Hohl BC, *et al*. Community greening, fear of crime, and mental health outcomes. *Am J Community Psychol* 2021;277.
39 Kaufman EJ, Passman JE, Jacoby SF, *et al*. Making the news: victim characteristics associated with media reporting on firearm injury. *Prev Med* 2020;141:106275.
40 Wardell CA, Barber R, Cook C. *A blueprint for a U.S. firearms data infrastructure*. NORC: University of Chicago, 2020.