

Changes in Shooting Incidence in Philadelphia, Pennsylvania, Between March and November 2020

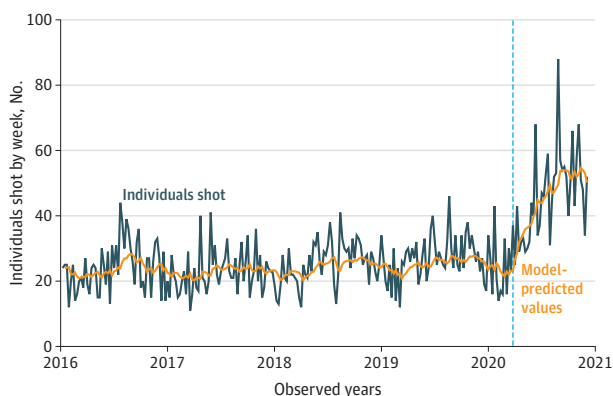
Firearm violence occurred more frequently in US cities in 2020 compared with previous years.¹ Two major events of 2020 may explain this increase: enactment of containment policies to reduce the spread of COVID-19 and a national reckoning with systemic racism, including widespread protests sparked by the police killing of George Floyd.¹ This study evaluated independent associations between COVID-19 containment policies and the killing of George Floyd on firearm violence in 1 US city, Philadelphia, Pennsylvania.

Methods | This study accessed data from the Philadelphia Police Department's registry of shooting victims from January 1, 2016, through November 26, 2020.² This registry is updated daily and includes all individuals shot and/or killed with a firearm as a result of interpersonal violence. There were no changes in data collection policies or practices in 2020. Compared with trauma center records, the police registry contains approximately twice the number of individuals shot with a firearm.³ Changes in counts of individuals shot per week were examined following 3 time points: the enactment of Philadelphia's first COVID-19 containment policy (closure of nonessential businesses; March 16, 2020), the killing of George Floyd (May 25, 2020), and the partial lifting of containment policies (June 26, 2020).¹

A time-series analysis was conducted using autoregressive integrated moving average (ARIMA) models. The dependent measure, a count of individuals shot per week, was log transformed to ensure normal distribution. Interruptions were specified the weeks of March 16, May 25, and June 26, 2020. We identified the ARIMA model by systematically testing local and 52-week seasonally lagged autoregressive, difference, and moving average terms to remove trends and account for temporal dependencies. Three transfer functions assessed associations between the interruption variables and the dependent measure, capturing abrupt permanent relationships (stepped change), gradual permanent relationships (asymptotic growth curve), and abrupt temporary relationships (immediate increase followed by gradual decline).⁴ We selected the best-fitting model based on ARIMA terms and transfer functions with 2-sided $P < .05$, autocorrelation and partial autocorrelation functions within 95% CI bands (calculated using the Bartlett formula), and low values for both the Ljung-Box Q statistic at 24 lags and the Akaike information criterion.⁴ Statistical models were estimated using SCA Workbench, version 6.3 (Scientific Computing Associates Corp). The Temple University institutional review board determined that this study was not human subjects research and did not require approval.

Results | During the 256 weeks included in the study, 7159 individuals were shot in Philadelphia, which breaks down to a mean of 24.9 (SD, 7.1) individuals shot per week during the 219 weeks before enactment of COVID-19 containment policies and a mean of 46.4 (SD, 13.5) individuals shot per week in the 37 weeks after containment policy enactment.

Figure. Individuals Shot by Firearms per Week in Philadelphia, 2016 to 2020



The vertical dashed line indicates the beginning of COVID-19 containment policies in Philadelphia (March 16, 2020). The model-predicted values show a gradual permanent association beginning with COVID-19 containment policies. The autoregressive integrated moving average model was specified as 1, 0, 1; the Ljung-Box Q statistic at 24 lags was 19.6.

The ARIMA model that best fit this time series included local autoregressive and moving average terms and a gradual permanent association beginning the week COVID-19 containment policies were enacted. The killing of George Floyd and the partial lifting of containment policies were not independently associated with any changes in shooting incidence. The **Figure** shows the observed and model-predicted incidence of individuals shot per week during the study period.

Discussion | These analyses provide evidence of a significant and sustained increase in firearm violence in Philadelphia following the enactment of COVID-19 containment policies. Counts of individuals shot per week continued to increase during protests following the killing of George Floyd and remained high during the partial lifting of containment policies until the end of the study period.

Limitations of this study include that it was restricted to 1 US city and may not be generalizable to other contexts. While Philadelphia police data are likely more complete than other available registries, the data do not include self-inflicted shootings; therefore, no conclusions may be reached about these types of shootings.^{3,5} Moreover, police data are not collected with the primary purpose of epidemiologic surveillance, and missing or inaccurate reports could bias the results presented.

Social and economic distress may account for the observed associations. In Philadelphia, firearm violence incidence has been empirically tied to poverty and structural place-based economic disinvestment.⁶ The sustained nature of the increase in firearm violence observed in this study may be related to longer-term effects of COVID-19 containment policies, including intensifying unemployment and poverty, particularly in lower-income Philadelphia communities where shootings are most concentrated.

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Accepted for Publication: February 2, 2021.

Published Online: February 10, 2021. doi:10.1001/jama.2021.1534

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Supervision: Goldberg.

Other (theoretical frameworks): Dong.

Conflict of Interest Disclosures: Dr Jacoby reported receipt of grants from the Rita and Alex Hillman Foundation and from University of Pennsylvania University Research Foundation outside the submitted work. No other disclosures were reported.

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Trends in Age at Natural Menopause and Reproductive Life Span Among US Women, 1959-2018

Menopause, the permanent cessation of menstruation for more than 12 consecutive months resulting from the loss of ovarian function, marks the end of a woman's reproductive cycle.¹ Trends of increasing age at natural menopause have been reported worldwide.² Understanding changes in the timing of age at natural menopause and length of reproductive life span (age at menopause minus age at menarche) and their associ-

ated factors are important because they influence multiple health conditions.¹ This study investigated 60-year trends in age at natural menopause and reproductive life span as well as associated factors among US women.

Methods | Data were from successive surveys spanning the National Health Examination Survey I (NHES I; 1959-1962) through the National Health and Nutrition Examination Survey (NHANES) for 2017-2018. Response rates ranged from 87% for the NHES I to 49% for NHANES 2017-2018. These surveys used similar standardized protocols to obtain nationally representative estimates for the US noninstitutionalized civilian population and were approved by the National Center for Health Statistics Research Ethics Review Board.³ All participants provided written informed consent. Ages at menarche and menopause were self-reported. All women aged 40 to 74 years with natural menopause and no missing age at menopause were included in this analysis. Women with the following characteristics were excluded: menopause due to medical treatment or other reasons, age at natural menopause before age 40 years or after age 62 years (because pathologic conditions may have influenced the occurrence of menopause at such ages),⁴ and reporting a race/ethnicity other than Black, White, or Hispanic. Trends in age at natural menopause and reproductive life span over time were examined using linear regression, while ordinal logistic regression was used to evaluate factors (Table 1) associated with higher age at menopause and longer reproductive life span. All models accounted for the complex design and sampling weights of the surveys using SAS version 9.4 (SAS Institute Inc). Consecutive 2-year surveys conducted after 1999 were grouped into 4-year intervals to produce statistically reliable estimates. A 2-tailed $P < .05$ indicates statistical significance.

Results | Of 9428 women aged 40 to 74 years at the time of the survey with natural menopause and without missing age at menopause, 1655 were excluded. Table 1 shows the characteristics of the 7773 included women. Overall, from 1959-1962 to 2015-2018, the mean age at natural menopause increased from 48.4 years to 49.9 years ($P < .001$ for trend). Over this interval, the mean reproductive life span increased from 35.0 years to 37.1 years ($P < .001$ for trend), while the mean age at menarche declined from 13.5 years to 12.7 years ($P < .001$ for trend). In adjusted models, Black or Hispanic race/ethnicity, poverty, current and former smoking status, and hormone therapy use were associated with earlier age at natural menopause and shorter reproductive life span, while greater years of education and oral contraceptive use were associated with later age at natural menopause and longer reproductive life span (Table 2).

Discussion | Over the past 6 decades, the mean age at natural menopause increased by 1.5 years and the mean reproductive life span by 2.1 years.

The increase in reproductive life span was driven both by increasing age at natural menopause and earlier age at menarche. Sociodemographic, lifestyle, and behavior factors were significantly associated with age at natural menopause and