California Center for Population Research
University of California - Los Angeles

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PWP-CCPR-2018-005

January 31, 2018

California Center for Population Research
On-Line Working Paper Series

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DRAFT: PLEASE DO NOT CITE WITHOUT AUTHOR'S PERMISSION

Version: January 31, 2018

Running head: gun-violence exposure and high school completion

Key words: violence exposure; educational attainment; neighborhood effects

Word count (without references or endnotes): 15,701

Reference word count: 1,253

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Abstract

I constructed a unique set of data from over 300 California law enforcement agencies, in conjunction with large-scale education microdata covering the high school outcomes of over 3.8 million California ninth-graders from the classes of 2003 to 2014 to examine the extent to which estimated effects of violence exposure, coupled with significant differences in violence exposure rates, contribute to population-level differences in educational attainment. I find that: (1) Gun-violence exposure rates are significantly related to mean dropout rates for Blacks and Hispanics, and are unrelated to mean dropout rates for Whites and Asians. (2) Gun-violence exposure effects on high school completion are not primarily mediated by learning losses (less than 25 percent of the effect), which suggests that gun-violence exposure related dropouts generally have the cognitive capability to excel beyond their realized levels of educational attainment. (3) Gun-violence exposure affects everyone. Blacks and Hispanics are most affected through elevated dropout rates. Exposure effects for Whites tend to manifest by way of higher intragroup variance in dropout rates. Both Whites and Asians are affected by lower levels of reading and math proficiency among high school graduates. (4) Estimates suggest that the Black-White (Hispanic-White) difference in gun-violence exposure levels is associated with 16 (19) percent of the Black-White (Hispanic-White) difference in California dropout rates over the last decade. Findings in this chapter provide clear evidence that negative effects of gun-violence have played a significant role in shaping state-level demographics.

1. Introduction

Young African-American men, on average, face a very different set of average mortality risks than their peers in other racial groups. Whites, Asians, Hispanics, and Native American men all share the same leading cause of death between the ages of 1 and 34: accidental injury. African-American men are the only group for whom homicide eclipses all other causes of death (CDC 2014). Homicide is the most common cause of death for black males between the ages of 15 and 34, and is attributed almost 50 percent of deaths between ages 15 and 24 (CDC 2014). Young African-American women face a similar pattern where homicide is frequently the second or third leading cause of death, occupying the rank held by cancer and suicide for white, Hispanic, and Asian women(CDC 2014). An estimated 67.9% of homicides in the United States involve the use of firearms, and the vast majority of these (68.5%) involve the use of handguns (Federal Bureau of Investigations Uniform Crime Report 2014). This suggests a clear link between firearms, and the mortality risks of young African-Americans.

Although the race specific estimates referenced above apply to specific age-graded racial groups, the hazards described are not uniformly distributed across group members. Victimization is most likely to occur in adolescence (McMillan 2001; Bowen and Bowen 1999). Violence is negatively correlated with socioeconomic status (Blau and Blau, 1982) indicating that youth from less educated and lower income households are more likely to have encounters. Homicide rates tend to be higher for teens living in urban areas (Finkelhor and Ormrod 2001). All 1997 youth homicides occurred in only 15 percent of US counties indicating a geographic and demographic concentration of crime and violence exposure (Finkelhor and Ormrod 2001).

The salience of homicide among the mortality risks of African-American youth indicates the volume of children and families who are affected by shootings. Firearm related events resulting in homicide represent a small proportion of firearm-related incidents. Gun-violence effects on cause-of-death estimates are fully driven by fatal shootings. Beyond these fatal shootings, estimates suggest that there are 2.3[1] times more non-fatal shootings that resulted in injury, and an unknown number of firearm related incidents that did not result in bodily injury (Center for Disease Control 2005). While not all gun-related events are lethal, all gun-related crime and violence can be a threat to feelings of safety and security. Evidence below indicates that children can be affected by a range of violent experiences that may or may not involve loss of life. For this reason, this work operationalizes gun-violence exposure as a concept that reaches beyond firearm related homicide to other forms of gun-related crime and violence.

Violence exposure and victimization have well documented psychological, physiological, and behavioral effects on children. Violence exposure is associated with the onset of post-traumatic stress disorder symptomology (PTSD) (Berman et al. 1996; Berton and Stabb 1996), depression (Moses 1999; Freeman, Mokros, and Poznanski 1993), and anxiety (Pynoos 1994; Hill et al. 1996)). There is evidence of nightmares and other anxiety related sleep disturbances (Pynoos 1994). Children report feeling unsafe, "jumpy", and "scared" (Richters and Martinez 1993; Osofsky, Wewers, et al 1993). Young children are less likely to explore their environment (Osofsky and Fenechel 1994), and may have difficulty paying attention or concentrating due to intrusive thoughts (Pynoos 1994). Among young children, regression in developmental achievements such as toileting and language is common (Drell et al. 1993). There is also evidence of cumulative effects of trauma (Cummings, Hennessy, Rabideau, and Cichetti 1994; Cummings and Zahn-Waxler 1992), suggesting that traumatic events early in childhood may compound the negative effects of later life difficulty. In adolescence, violence exposure is associated with greater risks of running away from home, attempting suicide, and encountering the criminal justice system (Haynie 2009).

Violence also affects a parent's ability to protect their child. Parents who are living with violence frequently express feelings of helplessness and frustration due to an inability to safeguard their children (Osofsky 1995 ; Garbarino et al. 1992; Lorion and Saltzman 1993; Osofsky, Wewers, et al 1993; Richters and Martinez 1992). Parents experience further

[1] Estimate based on counts of firearm related deaths, and firearm related non-fatal injury from years 2001 to 2014.

frustration when spaces, such as community centers, churches, and schools, are no longer viewed as safe places where their children are protected. This can leave parents feeling the need to be overprotective, and to challenge their child's autonomy due to an environment that does not safely admit exploration (Osofsky 1995).

All of these effects offer clear mechanisms and pathways that may mediate the estimated effects of exposure and victimization on the education, and adult outcomes, of children. There is evidence of short-term (Sharkey 2010) exposure effects that lower exam performance in the weeks that immediately follow an incident, as well as cumulative effects (Burdick-Will 2016) of violence exposure due to learning losses over time. Beyond test score effects, violence exposure and victimization can undermine one's fundamental need to feel safe, which must be met before prioritizing higher needs, such as education (Maslow1954). In agreement, McMillan and Hagan (2004, pp. 127) argue that, "… victimization diminishes educational self-efficacy, which subsequently undermines educational performance and attainment".

Evidence of negative causal effects of violence exposure on child outcomes is further supported by experimental evidence showing gains from moving to safer neighborhoods. Sharkey and Sampson (2010) found that Chicago residents who moved to safer neighborhoods beyond the city were less likely to become violent offenders. Positive effects were mediated by increased school quality, the change in neighborhood racial and economic makeup, and increased feelings of control over a new and safer environment. Also, evidence from a reanalysis of Moving to Opportunity (MTO) intervention data highlighted larger relocation effects for kids who moved in the study's most violent cities (Baltimore and Chicago). Data showed inverse correlations between beat-level crime, and reading and math test scores (Burdick-Will 2010), as well as psychological benefits for a parents and children of living in safer neighborhoods (Katz et al. 2001; Goering and Feins 2003). For these reasons and others, violence exposure is viewed as a key causal pathway linking neighborhood context, and individual behavioral and health outcomes (Galster 2012).

While studies assessing violence exposure effects are generally designed to understand the effects of living in high crime neighborhoods, the question of exposure effects has become increasingly applicable to kids who live in communities where gun-violence is relatively infrequent. Since 1999, shootings have occurred with increasing regularity on school grounds in community contexts absent of typical high-crime correlates. Violence exposures from lone incidents tend to have different characteristics relative to violence exposure in high crime areas. School shootings tend to occur over a brief period of time, with clear time point delineating the initiation and termination of the threat. Also, one event is usually not indicative that more violence is likely. This differs from gun-violence in high crime areas where violent occurrences tend to represent one event in a seemingly infinite sequence, and the threat of additional violence never truly subsides. A portion of violence exposure effects is attributable to the threat of additional harm. Because the types of exposure mentioned above differ in their expectations of future occurrences, they likely differ in their long-term effects on children. The estimates to follow are most reflective of the effects associated with exposure in high crime areas.

The literature above offers clear evidence that children are affected by violence exposure and victimization. Violence exposure has physiological, psychological, and behavioral effects that interrupt the day-to-day lives of children, and may partly mediate poorer education outcomes. Coupling this with evidence of population-level heterogeneity in exposure levels suggests the possibility of measurable population-level effects. I investigate this possibility below.

This paper has five key objectives. First, I assess gun-violence exposure patterns and identify significant differences in exposure levels between student subgroups. Second, I estimate race-specific total effects of gun-violence exposure on high school completion rates. Next, I estimate fixed effects models that show the extent to which gun-violence exposure rates are associated with variance in the success of high school cohorts from the same school at different points in time. With some assumptions, these estimates imply an upper bound on the causal effect of exposure on dropout rates. Fourth, I assess whether gun-violence related dropouts leave school earlier than other dropouts. Fifth, I exploit a

2006 California statewide policy change that adds an additional cognitive requirement for high school graduation, and facilitates estimates of gun-violence correlated skill differentials among California high school graduates. Sixth, I discuss whether learning losses are a dominant mediator in yielding lower educational attainment among children exposed to higher violence levels. Finally, I close with a discussion of findings and implications.

2. Data and Measures

2.1. Education Data

I employ education data that was collected and compiled by the California Department of Education (CDE). These data describe the performance of all ninth-graders who would have graduated from a California public high school between the years of 2003 and 2014, assuming a typical four-year high school plan. After restricting to observations with valid data for outcomes, gun-violence measures, and control variables, the data contain 280 California school districts, covering 756 California schools, and roughly 3.9 million[2] ninth-graders within the window of observation.

This work is primarily interested in understanding effects of gun-violence exposure on high school dropout rates. These data report grade-specific enrollment and dropout counts for grades 9 through 12. I divide grade-specific dropout counts by grade-specific enrollment counts to calculate grade-specific dropout rates. This is equivalent to the "1 year rate formula" employed by the CDE to calculate the dropout rate over one year. Grade-specific dropout rates for grade g are denoted, d_g. These grade-specific rates are used to calculate cohort-level dropout rates, d_{cohort}, according to:

$$d_{cohort} = 100 \cdot \sum_{g=9}^{12} \frac{d_g}{1 - d_g} \cdot \left[\prod_{k=0}^{g} (1 - d_k) \right]$$

[2] There are 3,877,529 students enrolled in grade 9 between the years 2000 and 2015 among the subset of observations that have valid dropout and CAHSEE data. Enrollment counts were taken at the beginning of each school year on a day in early October known as, "information day".

This four-year calculation is equivalent to the "Four-year derived Rate Formula" employed by the CDE.

I also employ data from California High School Exit Exam (CAHSEE) scores. Prior to the CAHSEE, the governing boards of all California school districts that maintain junior or senior high schools were required to, "adopt standards of proficiency in basic skills for pupils" (CA Senate Bill 2, 1999-2000 Session). The imposition of district-specific standards lead to noticeable differences in pupil requirements, and a legislative declaration that local proficiency standards are generally set below high school level, and are inconsistent with state content standards (CA Senate Bill 2, Section 1[a], 1999-2000). In response to this finding, the 1999 California state legislature ratified CAHSEE as the in-coming statewide pupil proficiency standard. This act had the dual objectives of improving pupil achievement, and ensuring that high school graduates can demonstrate grade-level competency in reading, writing and mathematics (CA Senate Bill 2, Section 1[b], 1999-2000). The legislation was initially directed to begin with the class of 2003, but was later delayed and not implemented until the class of 2006.

The CAHSEE assessment provides mathematics and English Language Arts (ELA) scores and pass rates for the school years beginning in 2001, and 2003-2014[3]. The CAHSEE math assessment includes sections on statistics, data analysis and probability, number sense, measurement and geometry, mathematical reasoning, algebra, and operations using decimals, fractions, and percents. The ELA section emphasizes vocabulary, spelling, grammar, punctuation, decoding, comprehension, writing strategies, writing applications, and analysis of information and literary texts (CAHSEE History, CDE). This paper employs the pass rates and standardized scores of the ELA and mathematics sections as a whole.

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[3] CAHSEE data for years 2001 to 2003 do not show ethnicity and grade together. They show performance by ethnicity for all grades, and grade specific performance in separate observations. The grade specific counts in 2001 and 2002 show that 10th graders were almost the only students tested. For this reason, I assume that all kids tested in these years are grade 10. 2003 has a substantial presence of 11th graders making this assumption invalid. I omit 2003 CAHSEE data for this reason. Since the 2003 CAHSEE data correspond to the school year that began in 2002, this results in the omission of 2002 CAHSEE data in the analysis.

Education data are observed at the $year \times school \times race \times grade$ level of observation. This means that I do not observe outcomes for individual students. However, I do observe the group level outcomes for all students in a designated racial group and grade at a chosen high school in a given year. For this reason, I do not observe the heterogeneity in outcomes between students in the same the $year \times school \times race \times grade$ designated group. However, I do observe differences in student outcomes and control measures between student groups. Since the treatment of interest (exposure to gun-violence) conceptually occurs at the $year \times school$ level, the loss of intragroup variance does not sacrifice any variance component that is correlated with the treatment. Thus, the remaining between group variance is sufficient for identifying the effect of interest.

2.2. Gun- Violence Data

Data on the gun-violence were collected and provided by the California Office of the Attorney General. These data list counts of specific classes of crimes at the agency level for all law enforcement agencies in the state of California. I only employ data from local police and county sheriff's offices as they are most likely to respond to gun-related crime reports. I omit reports from the California Highway Patrol, campus police agencies, the California Department of Parks and Recreation, hospital police, rail road and transit police, and other agencies with very specific jurisdictions that would not typically investigate shootings. The analysis employs data from 314 California law enforcement agencies.

The analysis focusses on three types of firearm related events: (1) Firearm related robbery; (2) Firearm related assault, and (3) Homicide. Homicide totals include both firearm related homicides, and those from other causes. These data does not allow isolating firearm related homicides. Evidence from the CDC finds that 69% of murders are firearm related (CDC 2014). For this reason, I use counts of all homicides as an instrument to gauge the effect of gun related homicide. I proceed with the understanding that the number of gun related homicides is overstated in the data. This should not affect the analysis, if there are no significant changes in the proportion of homicides that are gun-related over time.

Incident counts are translated into incident frequencies per 100,000 residents for the purpose of analysis. I employ agency level population estimates from the Law Enforcement Agency Identifier Crosswalk (LEAIC), 2012 (United States Department of Justice 2012), with an annual population growth rate estimate for California of 0.864% (United States Census Bureau 2016)[4]. With these data, I estimate incident counts per 100,000 individuals according to:

$$e_{ti}^{j} = 100{,}000 \cdot \left[\frac{\bar{e}_{it}^{j}}{\left(\frac{N_i}{1.00864^{(2012-t)}} \right)} \right].$$

e_{ti}^{j} denotes gun-related events per 100,000 individuals of type j, in year t, corresponding to law enforcement agency i. $\bar{e}$ denotes the total number events, and $N$is the year 2012 population estimate in locality i. This formula estimates events per 100,000 in a way that adjusts for population growth over the 11 year time span of the data. This avoids systematic error in the violence measures in the earlier years of the study. Unfortunately, I have no way to account for the heterogeneity in growth rates between California localities. I apply the state-level growth rate to all counties as a feasible alternative to using the true local growth rates, which are presently unavailable.

These data capture the variance in exposure across California communities, but cannot capture the variance in exposure within communities. Student subgroups from the same high school class will have identical exposure measures, but there may still be variance in their experience associated with intra-community spatial sorting. Outcomes and parameter estimates will capture this variance while, the gun-violence exposure measures will not.

2.3. American Community Survey Data

[4] The Census Bureau reports a 5.4% population growth rate over 6.25 years in the state of California from April 1, 2010 to July 1, 2016. This equates to an average annual statewide population growth rate of 0.864%.

Control measures were added from the USA Integrated Public Use Micro Data Series (IPUMS). I employ data from the year 2000 5% national sample, as well as American Community Surveys (ACS) for years 2001 to 2013. The year 2000 data include individual-specific data for 434,963 Californians. The ACS data for years 2001 to 2013 contain person-level data for 24,000 to 86,000 Californians in each ACS survey year. These data contain information concerning family structure, labor market outcomes, property values and rental rates, and household income that are useful as control variables.

The IPUMS data also contain identifiers that facilitate meaningful links to CDE data. Person-level identifiers include information on race, whether household members attend California public schools, and the respondent's geographic location in terms of the Public Use Microdata Area (PUMA) in which they live. I constrain the IPUMS data extract to only include respondents with students in California public schools. From there, I calculate means over $race \times year \times PUMA$ specific respondent subgroups. These data have 474 California PUMAs, 11 data years, and enough information on respondent race to construct racial groups that are consistent with CDE racial classifications. The average $race \times year \times PUMA$ combination contains 493 respondent level observations ($\mu = 493, \sigma = 503$). Control measures were estimated by taking means over these groups. Cases with insufficient data to estimate the year specific mean were imputed to the $race \times PUMA$ level mean. Medians were calculated for the income measure.

2.4. Merging Data from Multiple Sources

Figure 6.1 illustrates the geographic scope of the data that produced the analytic sample. The figure shows that schools and crime agencies are well distributed across the state of California capturing urban centers and rural areas. The more populous areas near Los Angeles, San Diego, and San Francisco have more schools, and more law enforcement agencies, which will help detect variance in gun-violence exposure levels, and dropout rates.

Education data, crime data, and IPUMS control measures were combined based on geographic proximity using ArcMap Software. Schools were geocoded to latitude and longitude coordinates based on the school's physical address as listed in the CDE data. Crime agencies were matched to localities with the same name, and the geographic jurisdiction of the agency was operationalized as the geographic boundaries of the locality. All schools that lie within a law enforcement agency's jurisdiction are assigned the crime event densities recorded by that agency. Schools were matched to IPUMS control measures in a similar fashion, such that a school's geographic coordinates were matched to its corresponding PUMA. School × race × year specific observations in CDE data were matched to the PUMA × race × year specific set of corresponding control measures from IPUMs data.

See Figure 6.2 for a graphic example of the geospatial matching process. The map shows the locations of schools in San Luis Obispo County, California. The upper left portion of the graph shows the Morro Bay Police Department matched to the incorporated area of Morro Bay City. Del Mar Elementary and Morro Bay High School are located within the Morro Bay City boundaries, and are thus matched to the crime data of the Morro Bay Police Department. Also, these schools are matched to control data for PUMA 0603701. Baywood Elementary, Los Osos Middle, and Monarch Grove Elementary do not lie within the boundaries of incorporated places, and would instead be matched to crime data from the San Luis Obispo Sheriff's office. They would, however, be matched to PUMA 0603701, as was the previous set of schools.

The geospatial matching process that links education data to law enforcement agencies and control variables was fairly successful. I created an ArcMap geocoder using publically available address feature files from the Bureau of the Census. This geocode successfully identified 88% of schools and 93% of law enforcement agencies. From here, I utilized a Texas A&M Geocoding service to geocode the remaining unmatched records. Among the focal student subgroups in this analysis (Black, White, Hispanic, and Asian), this process lead to the successful match of 99 percent of CDE observations to crime data, and 60 percent of CDE data to $year \times race \times PUMA$ specific IPUMS control variables. The remaining 40 percent were successfully imputed to $race \times PUMA$ specific control means.

2.5. Cross Sectional and Longitudinal Cohort Data Structures

These data were composed and analyzed in both a cross-sectional and longitudinal form. The cross-sectional representation was used to assess patterns in gun-violence exposure. The longitudinal transformation allows the estimation of gun-violence exposure effects on cohort-level dropout rates. See Chart 6.3 for a visual display of the longitudinal data transformation. The longitudinal transformation reshapes the data to place observations from grades 9, 10, 11, and 12 in successive years, into a single observation that follows a cohort over time. Cohort-level dropout rates were computed after this transformation, and thus, describe the eventual high school dropout rate of an entering high school cohort.

The cohort data were constructed with the imposition of two key assumptions.

(1) Low mobility between schools: Students tend to go to the same high school for the duration of their high school career. To control for variance in the accuracy of this assumption, I control for the proportion of the student body who attending the school for the first time in the present year.

(2) Regular promotion: Cohort construction assumes that students advance one grade every year. I control for variance in the accuracy of this assumption by controlling for school rank. Schools where students fail with higher frequencies should have a lower rank.

See Chart 6.3 for a visual display of cohort construction and key events over the course of the observation window for the education data.

Summary statistics for outcomes, mediators, and control measures are presented in Table 6.4 and Table 6.5. Means and standard deviations are listed for the full sample, and by gun-violence exposure level. Sample size measures are only presented for the full sample.

3. Analytic Approach

3.1. Gun-Violence Exposure Measurement and Observed Exposure Patterns

I study the effect of gun-violence exposure on school-level outcomes in a framework that uses per-capita crime rates to instrument for the dosage of violence exposure received by children. This approach is based in an underlying assumption concerning the visibility and pervasive presence of these events. Gun shots are loud, jarring, and self-publicizing. Acoustics research found that a range of handguns, including 0.357 Magnums, 0.38 Revolvers, and 9mm Pistols, generally fire at volumes between 150dB to 160dB (Beck et al. 2011). After sounds of this magnitude travel for a half-mile, they can still be as loud as 80dB[5]. This suggests that many people within a fairly large radius would be immediately aware that a shooting occurred.

Follow up events tend to offer additional publicity. This may include the sounds of police sirens and other emergency services personnel, as well as the images of police officers, squad cars, flashing blue and red lights, and yellow crime scene tape. In the worse cases, evidence of bloodshed and lost life may also be present. Media coverage of happenings often follows. Some variant of this sequence of events happens for every homicide, firearm related robbery, and firearm related assault in these data. When this happens frequently, it contributes to a neighborhood tone that affects businesses, residents, and children.

This work is focused on understanding the effects of three types of disturbances: (1) Firearm related robbery; (2) Firearm related assault, and (3) Homicide. The occurrence of these events is highly correlated ($\rho > .75$), and it appears that they may all contribute to a

[5] Statement based on estimates from a sound and distance calculator provided by http://www.sengpielaudio.com/calculator-distance.htm . Estimate was uses an initial sound volume parameter of 150dB, and a distance from the source of 3000 feet. Estimates do not control for competing noise, obstructions, and other environmental factors.

single shared effect on outcomes. Factor analysis supports this suspicion with evidence that all three measures heavily load on a single factor. Table 6.6 shows that all measures load on factor one with loadings that take values between 0.84 and 0.90. All factor one loadings exceed the threshold of 0.5 for "high" loadings, as described in Treiman (2009). Also, all factor two loadings fall below this mark. These factor loadings offer objective evidence that the selected measures capture a single unified concept contributing to a common effect.

I construct a composite exposure measure by taking the mean of standardized measures for each event according to

$$g = \frac{1}{3}\left(\sum_{i \in V} Z(v_i)\right)$$

where

$$Z(v_i) = \frac{v_i - \overline{v_i}}{\sigma(v_i)}$$

$$V = \{Firearm\ Robbery, Firearm\ Assault, Homicide\}.$$

$$v_i = Number\ of\ type\ i\ events\ per\ 100{,}000\ persons$$

This simple construction standardizes all measures, and takes a mean over the resulting z-scores. This composite measure has an inter-item covariance of 0.77 and reliability estimate ($\alpha = 0.91$).

Figure 6.7 and Table 6.8 offers snapshots of composite exposure over time. The earliest panel shows relatively high exposure rates for all student subgroups. This is confirmed by the table of means, which shows that all groups experienced their highest exposure levels between 1985 and 1995. Over the thirty-year period from 1985 to 2015, all groups experience noticeable declines in composite exposure with Blacks experiencing the greatest total change. With these declines, a new pattern emerges in the graphs. From 1995 forward, Whites and Asians increasingly have a greater density at low exposure levels, while Blacks and Hispanics display no reciprocating trend. This is most visible in the latest panel where there plots for Whites and Asians have a noticeably high density in the region below negative one. This shows that demographic differences in exposure persist in California even after massive declines over all, and agrees with evidence that national crime declines still left crime concentrated in areas that were initially most troubled (Sharkey and Friedson 2015). Refer back to Table 6.4 and Table 6.5 to observe differences in mean values of study variables above and below the $g = -1$ switching point.

A key objective of this paper is discerning whether the exposure differences consistent with the graphs above contribute to differences in educational outcomes. Table 6.8 lists mean differences in composite exposure rates between whites and all other groups based on 2015 data. Year 2015 composite exposure rates for Blacks and Hispanics exceed those for Whites by 2.27 and 1.27 points, respectively. Conversely, exposure for Asians is 3.44 points lower than exposure for Whites.

Do these mean differences matter for educational outcomes? To better assess this question, I construct group specific composite exposure measure, $\dot{g}_r$, by normalizing the measure, g, by the mean difference in exposure levels between Whites and African-Americans over the course of the sample window. Formally,

$$\dot{g}_r = \frac{g}{\mu_{White}(g) - \mu_r\ (g)}$$

$$r \in \{Asian,\ African - American,\ Hispanic\}.$$

Employing $\dot{g}_r$ as the primary gun-violence measure for group r has the benefit of producing regression estimates with an intuitive interpretation. The effect of a one unit change in $\dot{g}_r$ becomes synonymous with the estimated effect of shifting group $r's$ mean exposure level to the mean level of Whites over the sample window. To facilitate a cleaner presentation and comparable results between student subgroups, I employ $\dot{g}_{African-American}$ as my primary violence measure. Coefficients estimated from this measure can easily be translated into a comparable meaning for other groups by multiply by a factor of

$$\xi = \frac{\mu_{White}(g) - \mu_{African-American}(g)}{\mu_{White}(g) - \mu_r\ (g)}$$

for $r \in \{Asian,\ Hispanic\}$. I leave this transformation to the reader. For the remainder of the paper $g^{\cdot}$ should be interpreted as $g^{\cdot}_{African-American}$.

3.2. Regression Analysis

3.2.1. High Frequency Event Effects

I proceed with regression analysis by estimating linear regressions models and fixed effects models using the cohort data. These models aim to estimate two effects that accompany violence exposure. First, there is an effect of attending school, and likely residing, in area that frequently has violent incidents. High frequency violence is correlated with other factors that affect student well-being and performance. This may include effects on economic transactions (Bresbis et al. 2015) the presence and policies of local businesses (Greenbaum and Tita 2004; Tita and Greenbaum 2006), effects on parents and siblings (Osofsky 1995), and availability of food vendors and restaurants (Powel et al. 2007; Meltzer and Schuetz 2012; Morland et al. 2002). These factors are correlated with a neighborhood violence level as a whole, but they should not necessarily respond to individual violent acts. I employ a linear regression of the following form to estimate the effects high frequency crime.

$$y_{irc} = X_{irc}\,\beta_0 + \sum_{r \in Race}\left[\beta^{y}_{1r} \cdot \mathbb{I}(Race = r)\right] + \gamma^{y} \cdot g^{\cdot}_{irc} + \delta^{y}_{1} \cdot\ \mathbb{I}(Exit\ Exam\ Policy) + \epsilon_{irc}$$

$$\epsilon_{irt} \sim N(0, \Sigma_{\mathrm{i}})$$

In the expression above, X denotes a set of control measures, y is the outcome, and z is the composite gun-violence exposure index. The index variables $i, r,$ and $c,$ denote school, race, and class, respectively. δ_1 captures any effects of the change in graduation requirements to include passing CAHSEE. I also run variants of this model that estimate

$race \times exposure$ interaction effects. These regressions are estimated via maximum likelihood estimation to take advantage of the associated efficiency gains over least squares estimation. Standard errors are adjusted for clustering at the school level to adjust for school-specific variance components.

3.2.2. Fixed Effects for Causal Inference

The cohort data admit the estimation of fixed effects models that identify exposure effects based on variation in the performance of students from the same neighborhood who attended the same school at different points in time. Estimating effects based on the variance in performance within kids from the same neighborhood helps control for a range of observable and unobservable confounders. Variance in exposure derives mostly from variance in crime rates within neighborhoods across time. It would likely be incorrect to assume that whatever causes intra-neighborhood variability in crime rates has the exogeneity properties needed to facilitate causal inference in this context. I, instead, make the weaker assumption that factors generating more gun-violence do not also generate positive student outcomes at a detectable level. This assumption implies that the fixed effects estimates will contain a causal component, and a correlated component that works in the same direction. This facilitates the interpretation of the fixed effect as an upper bound on the true causal effect.

Fixed effects estimation proceeds as follows. Define $\bar{X}_{ir}^{L}$ as the mean value of control variables, X, for students at school i of racial group r across all available year of data. The superscript L indicates that the data has been reshaped to a longitudinal form that follows cohorts over time. Define deviations from this mean as $\tilde{X}_{irc}^{L} = X_{irc}^{L} - \bar{X}_{ir}^{L}$ and interpret $\tilde{y}_{irc}^{L}$ *and* $\tilde{z}_{irc}^{L}$ similarly. These are cohort specific deviations from the $race \times school$ level mean. The index c represents cohorts/high school graduating classes. I estimate fixed effects models of the following form.

$$\tilde{y}_{irc}^{L} = \beta_0 + \gamma^{\tilde{y}} \tilde{g}_{irc}^{L} + \beta^{\tilde{y}}\, \tilde{X}_{irc}^{L} + \delta_1^{\tilde{y}} \cdot \tilde{\mathbb{I}}(Exit\ Exam\ Policy) + \tilde{\epsilon}_{irc}$$

$$\tilde{\epsilon}_{irc} \sim N(0, \Sigma_{\mathrm{i}}^{\tilde{y}})$$

I will also check for $race \times exposure$ interaction effects in the context of this fixed effects model.

These models facilitates estimates concerning the degree to which violence exposure has affected the density of new high school graduates in California over the course of the sample window. This offers a partial characterization of the demographic effect of gun-violence exposure on educational outcomes, as well as effects on the labor supply of young workers with the diploma credential.

Evidence from the data show very little change in exposure levels from year to year. The correlation between exposure levels observed in grades 7, 8, and 9 is very high ($\rho > 0.90$). The correlation remains high when comparing grade 7 and grade 12 exposure ($\rho > 0.79$). This implies that exposure levels describe their year of origin, while providing a lot of information about future and past years. For this reason, all models employ gun-violence exposure measures measured in grade 8, with the expectation that these measures describe the violence level experienced across childhood. Models also control for covariates measured at grade 9, and employ grade 9 enrolment weights. Standard errors are adjusted for clustering at the school level to adjust for school-specific variance components.

3.2.3. Do *exposure-related dropouts leave school earlier than other dropouts?*

The data show the number of students who drop out at each grade level between grades 9 and 12. For each cohort, I calculate the average years of high school completed among high school dropouts in a given cohort according to:

$$\tau_{irc} = \sum_{m=0}^{3} \left[\frac{Grade(9+m)\ Dropouts_{irc}}{Total\ Cohort\ Dropouts_{irc}} \cdot m \right].$$

I employ this construct as an outcome in the linear regression above to estimate effects of gun-violence exposure on the timing with which dropouts leave school.

Models control for covariates measured at grade 9, and employs grade 9 enrolment weights. Standard errors are adjusted for clustering at the school level to adjust for school-specific variance components.

3.2.4. *Mediation Analysis*

I employ mediation analysis as described by Imai et al. (2010A; 2010B) to understand how high violence levels lead to higher dropout rates. Particularly, I would like to understand whether: (A) learning losses lead to difficulty satisfying the cognitive demands of high school, which increase dropout rates, or (B) exposure leads to learning losses, but these learning losses do not explain dropout patterns. Findings consistent with (A) would suggest that exposure is eroding learning, and leaving kids with less cognitive capability. Findings consistent with (B) would suggest that kids are cognitively capable of completing high school, but are largely dropping out for reasons unrelated to their intellectual potential.

Mediation models employ the following stage one and stage 2 models.

$$Stage\ 1:\ \ m_{irc} = \beta_{10} + X_{irc}\beta + \dot{g_{irc}} \cdot \gamma^{m_i} + \delta_1^y \cdot \mathbb{I}(Exit\ Exam\ Policy)$$

$$+ \sum_{r \in Race} \left[\beta_{1r}^y \cdot \mathbb{I}(Race = r)\right] + \epsilon_{irc}^1$$

$$Stage\ \ 2: y_{irc} = \beta_{20} + \kappa \cdot m_{irc} + X_{irc}\,\beta + \gamma^y \cdot \dot{g}_r + \delta_1^y \cdot \mathbb{I}(Exit\ Exam\ Policy)$$

$$+ \sum_{r \in Race} \left[\beta_{1r}^y \cdot \mathbb{I}(Race = r)\right] + \epsilon_{irc}^2$$

Mediation estimates are presented only in cases where there is a significant total effect of gun-violence exposure on dropouts, and a significant effect of gun-violence exposure on the mediator, m_{irc}. CAHSEE standardized scores and pass rates in mathematics and ELA are employed as mediators to discern the extent to which learning losses contribute to higher dropout rates.

As with earlier models, mediation models control for covariates measured at grade 9, and employs grade 9 enrolment weights. Standard errors are adjusted for clustering at the school level to adjust for school-specific variance components.

3.2.5. Estimating exposure related skill differentials among high school graduates using regressions discontinuity

The final analysis assess whether high school graduates appear to have exposure correlated differences in the skills with which they enter the labor market. This analysis adds an additional control variable, graduating class level University of California/California State University (UC/CSU) eligibility rates[6]. I add this control with the aim of focusing the analysis on the proportion of students who are most likely to enter the labor force immediately after high school.

To complete this analysis, I augment the cross sectional regression model defined above. First, I invert the outcome to predict the high school graduation rate, instead of the high school dropout rate. Next, I add an interaction between the exposure measure, and the CAHSEE policy indicator. The coefficient on this interaction estimates the extent to which the policy change differentially affected cohorts in high exposure areas by estimating the discontinuous jump in the dropout rate associated with both policy and exposure. The structure of the policy suggests that any additional dropouts failed the CAHSEE ELA and/or mathematics assessments, and thus, were below the state mandated proficiency level in at least one of these areas. Using these estimates, I calculate the proportion of non-college-bound high school graduates who were graduating with ELA and/or math skills below grade level.

[6] The UC/CSU eligibility rate for a graduating high school senior class is the proportion of students who complete 15 credits in specified subject areas with a grade of "C" or better, as required to meet admission course requirements for UC and CSU campuses. See Table 6.9 for a detailed listing of UC/CSU course eligibility requirements for entering freshmen.

Formally, the regression model can be represented as:

$$1 - y_{irc} = \gamma^{y} \dot{g}_{irc} + \beta_0^{y} X_{irc} + \delta_1^{y} \cdot \mathbb{I}(Exit\ Exam\ Policy)$$

$$+\delta_4^{y} \cdot \mathbb{I}(Exit\ Exam\ Policy) \cdot \dot{g}_{irc}^{L} + \delta_5^{y} \cdot UCCSU + \epsilon_{irc}$$

with

$$\epsilon_{irc} \sim N(0, \Sigma_{\mathrm{i}}^{y})$$

Using parameters from this model, I estimate the proportion of graduates who were likely graduating with ELA and/or math skills below state standards. Geometrically, this is the magnitude of the discontinuity divided by the expected graduation rate in the absence of the CAHSEE requirement. Define ω as the event that students graduate with English or Math proficiency below state levels. I estimate the probability of ω according to:

$$E\left(\omega \middle| \tilde{g}_{irc}(\cdot), UCCSU = 0\right) = E\left(\frac{\delta_4^{\tilde{y}}}{\widehat{[1 - \tilde{y}_{irc}]}} \middle| \tilde{g}_{irc}^{L}(\cdot),\ \ UCCSU = 0\right)$$

This estimates the proportion of non-college bound graduates who would have had substandard proficiency skills in the absence of the policy change. This is relevant because it is our best estimate of the proportion of graduates from earlier cohorts who may have had proficiency skills below California state ideals. Adjusting the value of $\tilde{g}_{irc}^{L}(\cdot)$ affords an understanding of the dependence of this proportion on composite exposure levels. A one unit change in $\tilde{g}_{irc}^{L}(\cdot)$ still captures the effect of shifting the mean exposure levels of African-Americans to the mean level observed for Whites. Constraining $UCCSU$ to a value of zero affords an estimate of the proportion of graduates that attempts to controls away the effect of likely college bound students.

The regression model above controls for covariates measured at grade 9, and employs grade 9 enrolment weights. Standard errors are adjusted for clustering at the school level to adjust for school-specific variance components.

4. Results

This paper aims to understand the extent to which gun-violence exposure contributes to persistent differences in the educational outcomes between student subgroups. Figure 6.10 shows cohort level dropout rates over time and by race for students in California High Schools. There are clear and persistent differences in the subgroup specific dropout rates over time. African-Americans and Hispanics consistently register the highest dropout rates, while Asians have the lowest rates. Until 2011, there is a consistent eight to twelve percentage point difference between the highest and lowest achieving groups. This gap has narrowed annually since 2011, and reached a difference in 2015 of four to six percent.

Table 6.11 lists mean dropout rates by race for the California public high school classes of 2003 to 2014. On average for this time period, African-American's and Hispanics dropout rates exceed the average for whites by 10.8 and 7.8 percentage points, respectively. Asians are the only group in this analysis with a lower dropout rate than the reference group, Whites.

Figure 6.12 shows that gun-violence exposure rates among California eighth-graders follows a pattern similar to dropout rates from the class of 2003 forward. Both figures show a slight inverted "u" shape since 2003. Forthcoming estimates investigate the relationship between these trends.

The section proceeds as follows. Subsection one briefly presents and discusses regression estimate for IPUMS and school level control variables. Subsection two presents estimates concerning the proportion of differences in dropout rates that is correlated with violence exposure. The third subsection bounds the proportion of this effect that may be causal. Subsection four assess whether violence exposure affects the timing with which dropouts leave school. Subsection five considers the mechanism mediating gun-violence exposure effects. Subsection six addresses whether gun-violence exposure affects the skill set that high school graduates take to the labor market.

4.1. Effect estimates for control variables.

Control variables in early models included PUMA level control measures from IPUMS, school and student subgroup level control variables from the CDE, missing value flags for the afore mentioned variables, and dummy variables to control for ethnicity differences. Significance levels on missing value flags were not significant predictors of cohort level dropout rates, indicating that missing values were non-systematic. Missing value flags were, however, correlated with the CAHSEE policy variable. Missing value flags were omitted from the final model to improve CAHSEE policy effect estimates.

Parent's education and household structure have the expected effects on dropout rates. Increasingly higher levels of education lead to increasingly lower likelihoods of dropping out. Student subgroups with a high density of kids from homes with an absent father are much more likely to dropout.

Among school characteristics, the largest effect is associated with classification as a school that is exclusively or primarily virtual[7]. According to present estimates, virtual schools in California are associated with a 20 percent higher dropout rate than schools with primarily classroom-centered instruction. Other outcomes in this study also showed poorer outcomes at virtual schools. These estimates are consistent with evidence from, In the Public Interest (2015) (ITPI), assessing the performance of California virtual schools. ITPI studies a particular vendor of virtual education services, and finds low graduation rates, negative academic growth, and consistently poor annual performance index rankings. ITPI attributes poor performance to a range of factors, including the financial model associated with California's virtual schools, low quality educational materials, and low pay for teachers and staff.

Estimates show no significant effects of CAHSEE legislation on cohort level dropout rates over the course of the sample window. Later estimates will restrict to the sample

[7] Exclusively virtual implies that the school has no physical building where students meet with each other or with teachers, and all instruction is virtual. Primarily Virtual implies that the school focuses on a systematic program of virtual instruction but includes some physical meetings among students or with teachers. Classification as exclusively or primarily virtual are CDE determined.

years immediately preceding and following the policy change to estimate a discrete positive discontinuity in the dropout rate associated with the new policy.

Other control variables have the expected sign. The dropout rate decreases as parent's education increases. The dropout rate is increases slightly with the proportion of kids receiving free and reduced price lunch. It decreases with the proportion of kids in gifted and talented programs or migrant education programs. Teachers with full credentials are associated with lower dropout rates, while classification as a charter school or magnet school is associated with higher dropout rates. Schools that are better ranked produce fewer dropouts, and traditional schools (as opposed to Juvenile Court Schools, Special Education Schools, and other targeted types of instruction) have lower dropout rates. The dropout rate is increasing in the proportion of the local population who is out of the labor force, and in the proportion of households with no father present. The local log median income is also inversely associated with dropout rates. See Table 6.13. These estimates instill confidence that control measures are capturing relevant patterns in the data, facilitating cleaner estimates of key effects of interest.

4.2. Gun-violence exposure effect estimates on cohort level dropout rates.

Table 6.13 presents estimates of gun-violence effects on high school cohort level dropout rates for the full sample, as well as by gender. The main effect of gun-violence exposure is associated with a 1.6 percent increase in the dropout rate for the full sample. The effect is slightly higher for men at 1.8 percent, compared to 1.3 percent for women. All estimates are highly significant.

Recall that I normalized the gun-violence index such that a one unit change in the index corresponds to the difference between the average gun-violence exposure levels of African-American versus white students in these data. This yields the interpretation that decreasing population exposure by this difference could lower the statewide high school dropout rate by up to 1.6 percent.

Table 6.14 adds an interaction between gun-violence exposure and student race/ethnicity, and Table 6.15 shows the total effects associated with these interactions. The total effects show that dropout rates for African-Americans and Hispanics are associated with gun-violence exposure at the highest listed significance level. Conversely, estimates for Whites and Asians are insignificant. This pattern of significance suggests that gun-violence exposure only effects educational attainment when exposure exceeds some threshold. While this threshold remains unidentified, evidence suggest that Blacks and Hispanics tend to be above the threshold, while Whites and Asians tend to be below. These estimates do no imply that Whites and Asians are unaffected by violence exposure. Instead, they imply that the density of affected individuals within these groups is too small to yield detectable group-level effects. These results provide evidence that the population-level effects of gun-violence exposure on high school completion are concentrated among African-American and Hispanic youth.

The magnitude of total effects for African-American and Hispanic males is strikingly large. A normalized index unit is associated with a 1.9 (2.5) percentage point differences in the African-American (Hispanic) male dropout rates, respectively. Estimates are slightly lower for the full sample. According to these estimates, had gun-violence exposure rates been lower over the last decade to a degree equivalent to the Black-White (Hispanic-White) exposure differentials, the Black-White (Hispanic-White) dropout differentials may have been lowered by up to 16.2 (19.2) percent.

4.3. Fixed effect estimates of gun-violence exposure and causal inference

This section presents fixed effect estimates of the effects of gun-violence exposure on high school dropout rates. These estimates use the variation in exposure and dropout rates for student who attended the same school at different points in time to estimate effects of gun-violence exposure. For this reason, the estimates can be understood as the best approximation of the greatest extent to which dropout rates within a school may vary with, or respond to, differences in gun-violence exposure.

Table 6.16 shows main effect estimates that lie between 1.7 and 2.1 percent, depending upon the sample. Males continue to register the largest effects. Table 6.17 ads race-by-exposure interactions, yielding the total effect estimates in Table 6.18. These estimates present a very different picture relative to the estimates in the previous subsection.

First, while the dropout rates of white students were unaffected by gun-violence exposure in the cross-sectional analysis, the intragroup variance in their high school outcomes appears to be heavily associated with violence exposure. Estimates suggest that the within-school dropout rate for White can vary by up to 2.1 percent with a unit change in gun-violence exposure index. Conversely, estimates for Asians are all insignificant. These estimates show that the high school dropout rates of White students is also affected by gun-violence exposure levels.

Estimates for African-Americans are noticeably high, with full sample effect estimates of 2.9 percentage points, and estimates for males approaching 3.3 percentage points. These fixed effect estimates are noticeably higher than cross-sectional estimates from the previous section. This suggests that predictors used in the previous section that were omitted from the present model may have captured a portion of the exposure effect.

Fixed effects can be employed for causal inference under certain assumptions, including exogenous variation in the independent variable of interest (Moore and Brand 2016). In this application, this would imply assuming that variation in gun-violence rates within a neighborhood over time is uncorrelated with other observable and latent factor that may affect the outcome of interest. While this may be a fair assumption in certain specific cases, it is likely not a fair general assumption for a decade of statewide change in gun-violence levels. For this reason, I take the stance that variation in crime is likely due to a combination of factors, some of which may be related to dropout rates. I make the conjecture that factors significantly associated with both crime and education tend to be positively associated with crime rates and negatively associated with educational outcomes. This assumption implies that there are no confounding dynamics at the population level that both decrease crime rates, and worsen student outcomes. This would imply that fixed effect estimates are composed of the causal effect of crime, as well as an additional confounding effect that works in the same direction. Absent a way of isolating the causal component of this effect, one may interpret the fixed effects as an upper bound for the causal effects of a unit change in the gun-violence exposure index. This argument implies that the causal effect of gun-violence exposure on dropout rates is bounded above by between 0 and 2.8 percent across both genders, depending upon the subgroup of interest.

4.4. Effects of gun-violence exposure on the years of completed schooling for high school dropouts.

The timing of school-leaving for high school dropouts has significant implications for later life outcomes. Oreopoulos (2007) exploits variation in compulsory schooling laws to find that dropouts with an additional year of education before leaving school report better health, lower unemployment rates, and 15 percent higher lifetime earnings. This motivates the question of whether violence exposure affects the timing with which dropouts leave school.

The main effects in Table 6.19 show no effects on the timing of dropping out. Coefficients for all samples are negative, but none are significant at standard levels. Table 6.20 adds race-exposure interactions producing the total effects in Table 6.21. Results are insignificant for African-Americans, Asians, and Whites. Results for Hispanics attain low levels of significance. The estimates suggest a loss of roughly 9 to 12 days of school for Hispanic dropouts.

Evidence indicates no noticeable effect of violence exposure the number of years of completed education among high school dropouts.

4.5. Mechanisms mediating gun-violence exposure effects.

This section aims to determine whether dropout effects are mediated by cognitive learning losses. This will help assess whether dropouts tend to leave school due to academic difficulty that may be associated with cumulative learning loss, or conversely, if students are dropping out of school in spite of their ability to meet the demands of coursework. To address this question, I use a mediation model (Imai, Keele, Tingley 2010; Imai, Keel, Tingley and Yamamoto 2010; Imai, Keele, Yamamoto 2010) that employs mathematics and English language arts scores from grade ten CAHSEE as mediation instruments. This approach estimates the proportion of the total effect of gun-violence on dropout rates that is mediated through cognitive pathways. I only employs data for African-American and Hispanic students since they were the only groups with significant cross - sectional effects to be mediated.

Table 6.22 shows the effects of violence exposure on cognitive mediators. There are significant negative effects for violence exposure on all listed mediators and effects are larger for ELA mediators than for math.

See Table 6.23 for estimates of direct and indirect effects, as well as the proportion of the total gun-violence effect mediated by cognitive measures. Summing the direct and indirect effects yields estimates of the total effect of gun-violence on a specified dropout rate. Among Blacks and Hispanics, a normalized unit change gun-violence index has an estimated total effect of increasing the dropout rate by about 1.7 percentage points. This estimate is slightly higher for young men (1.9 percentage points) and slightly lower for young women (1.4 percentage points).

Across all mediators and all dropout measures, the estimates of the percent mediated by cognitive pathways (last column of Table 6.23) indicate that cognitive pathways are not the driving factor behind the estimated total effects. The CAHSEE measures mediate 16 to 23 percent of the total effect of violence exposure on dropout rates. This suggests that something beyond cumulative learning loss connects violence exposure and dropout rates.

The proportion mediated is slightly lower for males than females, potentially indicating that violence is more cognitively disruptive for women. Also, mathematics indirect effects are consistently larger than English indirect effects, suggesting that learning losses associated with exposure may affect mathematics progress more heavily.

Overall, these estimates show that non-cognitive factor mediate 75 percent of exposure effects, indicating that cognitive factors associated with learning loss may not be the key link between violence exposure and decreased educational attainment.

4.6. Effects of gun-violence exposure on the skill level of high school graduates.

This section uses the 2006 implementation of the California High School Exit Exam (CAHSEE) requirement to estimate the proportion of kids from previous years who likely graduated with proficiency levels below state standards, and to test the association between this proportion and violence exposure levels.

Using data from the classes of 2004 to 2007, I estimate the discrete change in the dropout rate associated with the 2006 policy requiring successful completion of the English language arts and mathematics sections of CAHSEE. Estimates in Table 6.24 show that CAHSEE had the short-term effect of increasing dropout rates by about one percentage point sample-wide. The effects were slightly higher for males and slightly lower for females.

These percentages represent the proportion of students who would have graduated a year earlier under previous state policy, but did not satisfy the cognitive requirement imposed by CAHSEE for classes 2006 and later. I divide this percentage by the estimated proportion of graduates in the absence of CAHSEE to estimate the proportion of graduates from earlier cohorts who might have also been below state standards in their ELA and math proficiency.

Table 6.25 shows estimates for the total effects of CAHSEE, as well as estimates for the proportion of student graduating with ELA and math skills below state standards. For each entry, I present total effect estimates, and then estimates of the proportion of students below grade level when the total effect is significant. An insignificant total effect implies no increase in the dropout rate for a given group, which implies that there was no identifiable measure of the population that was likely below grade level in ELA or mathematics. For this reason, there are no estimates for the proportion below state standards if the total effect of the policy is insignificant.

The first panel shows the pure effect of CAHSEE with no interactions to identify violence effects. Sample wide, the dropout rate increased by about 1 percentage point. This implies that 1.1 percent of graduates from earlier cohorts may have been below state standards in mathematics and/or English. Across racial groups, African-Americans experienced the greatest bump in the dropout rate with a total increase of 1.6 percentage points at a moderate level of statistical significance. Whites and Asians followed with dropout increases of approximately 1.3 percentage points each. Hispanics were the only group for whom the dropout rate did not significantly change with the CAHSEE policy.

These estimates are based on a static framework that does not consider the possibility that CAHSEE had multiple effects. Beyond the effects of CAHSEE on the dropout rate, the imposition of the policy also led to an immediate significant improvement in CAHSEE pass rates. The first two high school classes to take the CAHSEE as a graduation requirement had a 2 percent (0.5 percent) higher pass rate one the ELA (math) section, than the las two classes to take the exam without consequence. This appears to be an incentive motivated performance improvement. This performance improvement suggests that the true proportion of graduates with proficiency levels below state standards before CAHSEE could be two to three times higher than the estimates presented above.

The second panel shows interactions between the CAHSEE policy, race, and gun-violence exposure. While there is no evidence of a significant full sample total effect, there is evidence of effects among White and Asian graduates. When considering violence exposure, the dropout discontinuity jumps to approximately 2.0 and 1.8 percentage points for Whites and Asian's, respectively. Both estimates correspond to roughly 2 percent of graduates falling below state proficiency standards. Violence exposure had no detectable effects on the change in the dropout rate for Blacks and Hispanics. Because these estimates do not formally account for the improvement in pass rates that accompanied the CAHSEE policy, the results should be viewed as conservative.

These estimates highlight two important findings. First, the lack of significant results from interacting CAHSEE with violence exposure indicates that cognitive factors are likely not the major mediating factor in explaining why violence exposure leads to higher dropout rates. This result agrees with findings in the previous subsection. Second, gun-violence exposure has an effect on every student subgroup in this sample. While exposure tends to lead to higher dropout rates for Blacks and Hispanics, it leads to lower proficiency rates among high school graduates for Whites and Asians. Both effects are relevant.

5. Conclusions and Discussion

The key finding of this work is that gun-violence exposure negatively affects everyone in some way. Among Blacks and Hispanics, exposure significantly contributes to higher dropout rates. Reducing the exposure levels of Blacks to mean levels comparable to Whites is associated with closing 16 percent of the Black-White gap in dropout rates in the state of California over the last decade. Decreasing the exposure of Hispanics to close the Hispanic-White exposure gaps is associated with closing 19 percent of the White-Hispanic dropout differential over the same time-period.

Cognitive measures mediate roughly 16 to 23 percent of gun-violence exposure effects on dropout rates. Evidence from the CAHSEE analysis provide additional evidence that violence exposure is not primarily influencing dropout rates through cognitive factors associated with learning loss. This means that the majority of the effect is mediated by factors unrelated to academic ability.

Cross sectional estimates for Asians and Whites show no significant effects of violence exposure on dropout rates. However, fixed effect estimates show that exposure is responsible for significant intragroup variation in high school completion of Whites. Also, evidence from the CAHSEE policy analysis shows that violence exposure is associated with an increased likelihood of having sub-standard English and math proficiency among White and Asian high school graduates. This has negative implications for skill level of new high school graduates upon entering the labor market. A similar significant effect was not identified among Blacks and Hispanics.

The absence of measurable exposure effects on Asians and Whites serves as an indication that violence exposure only effects academic success when levels exceed a certain threshold. Although I presently have no point estimate for the threshold value, I can claim with confidence that it must lie above the mean exposure level of White, and below the mean exposure level of Hispanics.

Fixed effects estimates, offer an upper bound for the likely causal effect of violence exposure on dropout rates. Upper bounds range between 2 and 3.3 percent, depending on the sample. This suggests that lowering violence exposure by an amount equivalent to the Black-White exposure differential may lower dropout rates within a school by up 3.3 percent, at most.

Finally, I find state-level evidence that gun-violence exposure is concentrated mostly among Blacks and Hispanics. Figure 6.7 offers visual evidence that exposure has decreased sharply over the last three decades. However, a pattern is clearly emerging where Whites and Asians are located in low crime areas at much greater densities than Blacks and Hispanics. This pattern suggests that outcomes differences exacerbated by violence exposure are likely to persist.

These findings suggest several clear directions for future work. First, it would be beneficial to have a more precise understanding of how gun-violence exposure affects racial differentials in educational attainment. Specifically, future work will decompose effects into components attributable to racial differences in exposure versus racial differences in effects. This may indicate which is more beneficial to students between policies directed at crime reduction, and policies directed towards mitigating effects.

Next, we need a better understanding of the mediators that transmit the last 75 percent of exposure effects on dropout rates. Understanding these mediators should offer guidance concerning what policies may dampen gun-violence exposure effects. This limited extent to which cognitive pathways mediate effects suggests that efforts to address learning loss, while important, may not address the primary problem.

Third, it would be beneficial to have a point estimate defining the threshold where gun-violence exposure levels begin having measurable effects on educational attainment. While the point estimate of an exposure index may be unintuitive at face value, it could be mapped back to crime densities that have an applied value. This tool could be used to identify schools that are likely affected by gun-violence exposure, and target those schools with specific resources aimed at dampening effects. Such a criterion could also be used to identify locations for new schools where violence exposure would not affect student outcomes.

The findings above provide evidence that gun-violence clearly has population-level effects on the educational attainment and skill levels of kids in the state of California. These findings likely apply to other states and cities, and more work is needed to understand the best approaches to combatting these problems.

References

Beck, Steven D., Hirotaka Nakasone, and Kenneth W. Marr. "Variations in recorded acoustic gunshot waveforms generated by small firearms." *The Journal of the Acoustical Society of America* 129.4 (2011): 1748-1759.

Berman, Steven L., et al. "The impact of exposure to crime and violence on urban youth." *American journal of Orthopsychiatry* 66.3 (1996): 329-336.

Berton, Margaret Wright, and Sally D. Stabb. "Exposure to violence and post-traumatic stress disorder in urban adolescents." *Adolescenc*e 31.122 (1996): 489-498.

Besbris, Max, et al. "Effect of neighborhood stigma on economic transactions." *Proceedings of the National Academy of Sciences* 112.16 (2015): 4994-4998.

Besbris, Max, Jacob Faber, Peter Rich and Patrick Sharkey. 2015. "The effect of neighborhood stigma on economic transactions." *Proceedings of the National Academy of Sciences* 112(16) 4994-8.

Blau, Judith R., and Peter M. Blau. "The cost of inequality: Metropolitan structure and violent crime." *American Sociological Review* (1982): 114-129.

Bowen, Natasha K., and Gary L. Bowen. "Effects of crime and violence in neighborhoods and schools on the school behavior and performance of adolescents." *Journal of Adolescent Research* 14.3 (1999): 319-342.

Burdick-Will, Julia. "Neighborhood violent crime and academic growth in Chicago: lasting effects of early exposure." *Social Forces* 95.1 (2016): 133-158.

California High School Exit Examination, California Department of Education Memo (2016). "History: Overview of the California High School Exit Examination (CAHSEE)."See CDE website at www.cde.ca.gov/ta/tg/hs/

Centers for Disease Control and Prevention, National Center for Injury Prevention and Control. Web-based Injury Statistics Query and Reporting System (WISQARS) [online]. (2005) [Accessed 13 September 2017]. Available from URL: www.cdc.gov/injury/wisqars

Center for Disease Control 2014. "Estimates on murders and cause of death."

Center for Disease Control 2014. "Leading Causes of Death in Males and Females by Race".

Cummings, E. Mark, and Carolyn Zahn-Waxler. "Emotions and the socialization of aggression: Adults' angry behavior and children's arousal and aggression." *Socialization and aggression*. Springer Berlin Heidelberg, 1992. 61-84.

Cummings, E. Mark, et al. "Responses of physically abused boys to interadult anger involving their mothers." *Development and Psychopathology* 6.1 (1994): 31-41.

Drell, M. J., Siegel, C. H., & Gaensbauer, T. J. (1993). Post-traumatic stress disorder. In C. H. Zeanah, Jr. (Ed.), Handbook of infant mental health (pp. 291-304). New York: Guilford Press.

Federal Bureau of Investigations Uniform Crime Report 2014, Crime in the US 2014, Offenses known to law enforcement, expanded homicide. https://ucr.fbi.gov/crime-in-the-u.s/2014/crime-in-the-u.s.-2014/offenses-known-to-law-enforcement/expanded-homicide

Finkelhor, David and Richard K. Ormrod. "The homicides of children & youth". Juvenile Justice Bulletin - NCJ187239, (pgs. 1-12). Washington, DC: US Government Printing Office (2001)

Freeman, Linda N., Hartmut Mokros, and Elva O. Poznanski. "Violent events reported by normal urban school-aged children: Characteristics and depression correlates." *Journal of the American Academy of Child & Adolescent Psychiatry* 32.2 (1993): 419-423.

Friedson, Michael and Patrick Sharkey. 2015. '"Violence and Neighborhood Disadvantage after the Crime Decline." *The Annals of the American Academy of Political and Social Science* 660:341-358.

Friedson, Michael and Patrick Sharkey. 2015. '"Violence and Neighborhood Disadvantage after the Crime Decline." *The Annals of the American Academy of Political and Social Science* 660:341-358.

Galster, George C. "The mechanism (s) of neighbourhood effects: Theory, evidence, and policy implications." *Neighbourhood effects research: New perspectives*. Springer Netherlands, 2012. 23-56.

Garbarino, J., Dubrow, N., Kostelny, K., & Pardo, C. (1992). The Jossey-Bass social and behavioral science series and the Jossey-Bass education series. Children in danger: Coping with the consequences of community violence. San Francisco: Jossey-Bass.

Goering, John M., and Judith D. Feins, eds. Choosing a better life?: Evaluating the moving to opportunity social experiment. The Urban Insitute, 2003.

Gorman-Smith, Deborah, and Patrick Tolan. "The role of exposure to community violence and developmental problems among inner-city youth." *Development and psychopathology* 10.1 (1998): 101-116.

Greenbaum, Robert T., and George E. Tita. "The impact of violence surges on neighborhood business activity." Urban Studies 41.13 (2004): 2495-2514.

Haynie, Dana L., et al. "Exposure to violence in adolescence and precocious role exits." *Journal of youth and* adolescence 38.3 (2009): 269-286.

Hicks, Raymond and Dustin Tingley (2011) mediation: Stata package for causal mediation analysis.

Hill, Hope M., et al. "Exposure to community violence and social support as predictors of anxiety and social and emotional behavior among African American children." *Journal of Child and Family Studies* 5.4 (1996): 399-414.

Imai, K., L. Keele, and D. Tingley. 2010. (A) A general approach to causal mediation analysis. *Psychological Methods* 15: 309-334.

Imai, K., L. Keele, and T. Yamamoto. 2010.(B) Identification, inference, and sensitivity analysis for causal mediation effects. *Statistical Sciences* 25: 51-71.

Imai, K., L. Keele, D. Tingley, and T. Yamamoto. 2010. Causal mediation analysis using R. In Advances in Social Science Research Using R, ed. H. D. Vinod, 129-154. New York: Springer.

In the Public Interest, February 2015. "Virtual Public Education in California" (Policy Brief). In the Public Interest, 2040 S Street NW, 2nd Floor, Washington, DC 20009. INTHEPUBLICINTEREST.ORG

Jondou Chen, 2013, Leave No Crime Behind: Exposure to Violence and School Performance in New York City, Columbia University Academic Commons, https://doi.org/10.7916/D8BV7PPN.

Katz, Lawrence F., Jeffrey R. Kling, and Jeffrey B. Liebman. "*Moving to opportunity in Boston: Early results of a randomized mobility experiment." The* Quarterly Journal of Economics 116.2 (2001): 607-654.

Kessler, Ronald C. and William J. Magee. 1994. "Childhood Family Violence and Adult Recurrent Depression." *Journal of Health and Social Behavior* 35:13-27.

Lorion, Raymond P., and William Saltzman. "Children's exposure to community violence: Following a path from concern to research to action." *Psychiatry* 56.1 (1993): 55-65.

MacMillan, Ross. 2001. "Violence and the Life Course: The Consequences of Victimization for Personal and Social Development." *Annual Review of Sociology* 27:1-22.

Meltzer, Rachel, and Jenny Schuetz. "Bodegas or bagel shops? Neighborhood differences in retail and household services." *Economic Development Quarterly* 26.1 (2012): 73-94.

Morland, Kimberly, et al. "Neighborhood characteristics associated with the location of food stores and food service places." *American journal of preventive medicine* 22.1 (2002): 23-29.

Moses, Anne. "Exposure to violence, depression, and hostility in a sample of inner city high school youth." *Journal of adolescence* 22.1 (1999): 21-32.

Moses, Anne. 1999. "Exposure to Violence, Depression, and Hostility in a Sample of Inner City High School Youth." *Journal of Adolescence* 22:21-32.

Oreopoulos, Philip. "Do dropouts drop out too soon? Wealth, health and happiness from compulsory schooling." *Journal of public Economics* 91.11 (2007): 2213-2229.

Osofsky, Joy D., and Emily Fenichel. Caring for Infants and Toddlers in Violent Environments: Hurt, Healing, and Hope. Vol. 13. No. 3. Zero to Three, PO Box 25494, Richmond, VA 23260-5494, 1994.

Osofsky, Joy D., et al. "Chronic community violence: what is happening to our children?." *Psychiatry* 56.1 (1993): 36-45.

Powell, Lisa M., Frank J. Chaloupka, and Yanjun Bao. "The availability of fast-food and full-service restaurants in the United States: associations with neighborhood characteristics." *American journal of preventive medicine* 33.4 (2007): S240-S245.

Pynoos, R. S. (1994). Traumatic stress and developmental psychopathology in children and adolescents. In R. S. Pynoos (Ed.), Posttraumatic stress disorder: A clinical review (pp. 65-98). Baltimore: The Sidran Press.

Richters, John E., and Pedro Martinez. "The NIMH community violence project: I. Children as victims of and witnesses to violence." *Psychiatry* 56.1 (1993): 7-21.

Tita, George E., Tricia L. Petras, and Robert T. Greenbaum. "Crime and residential choice: a neighborhood level analysis of the impact of crime on housing prices." *Journal of quantitative criminology* 22.4 (2006): 299.

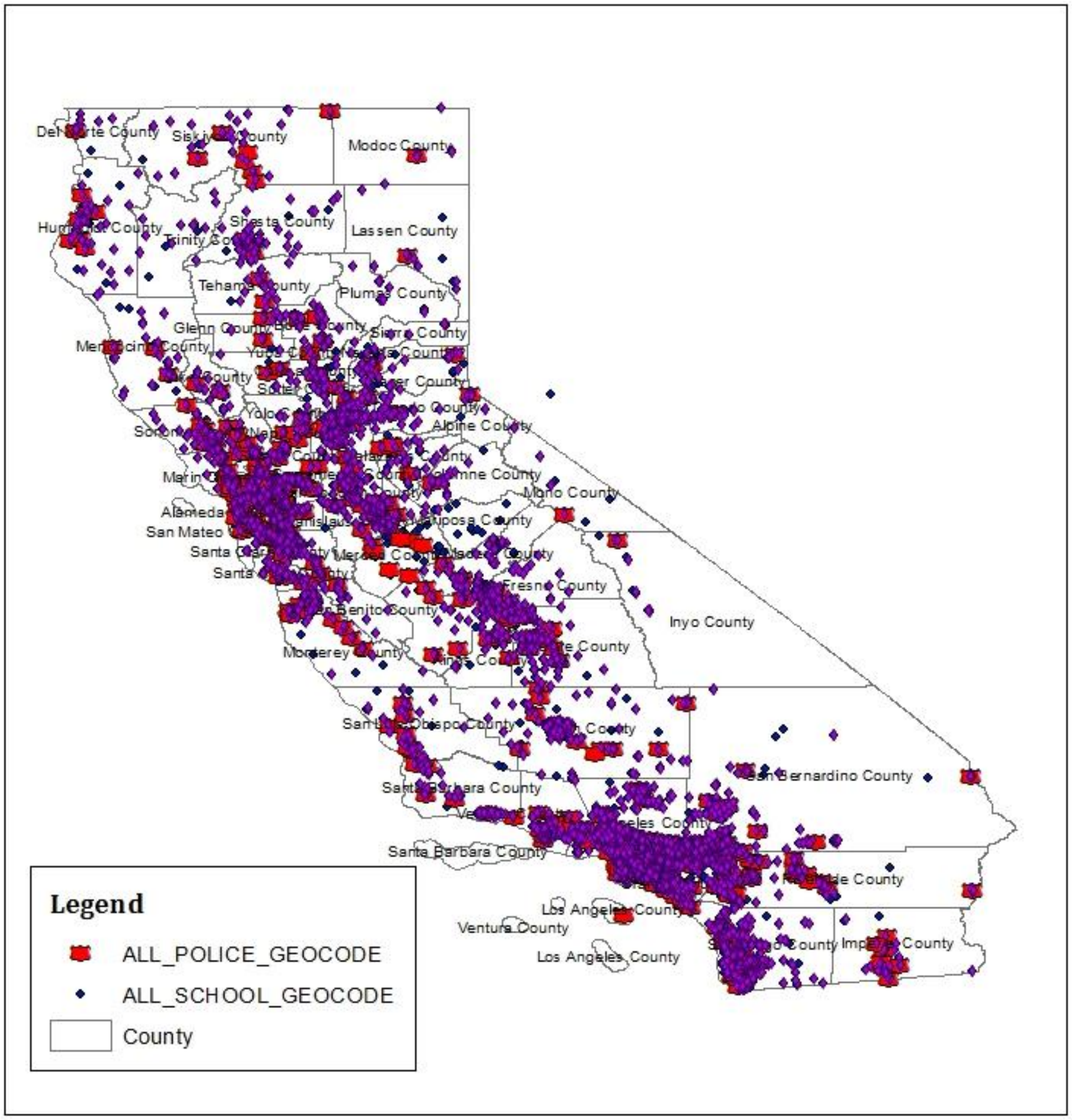
Treiman, Donald J. "Quantitative Data Analysis: Doing Social Research to Test Ideas (*Research Methods for the Social Sciences*)."Pp.248. (2009).

United States Census Bureau, Quick Facts: California https://www.census.gov/quickfacts/fact/table/CA/AFN120212 Accessed August 19, 2017

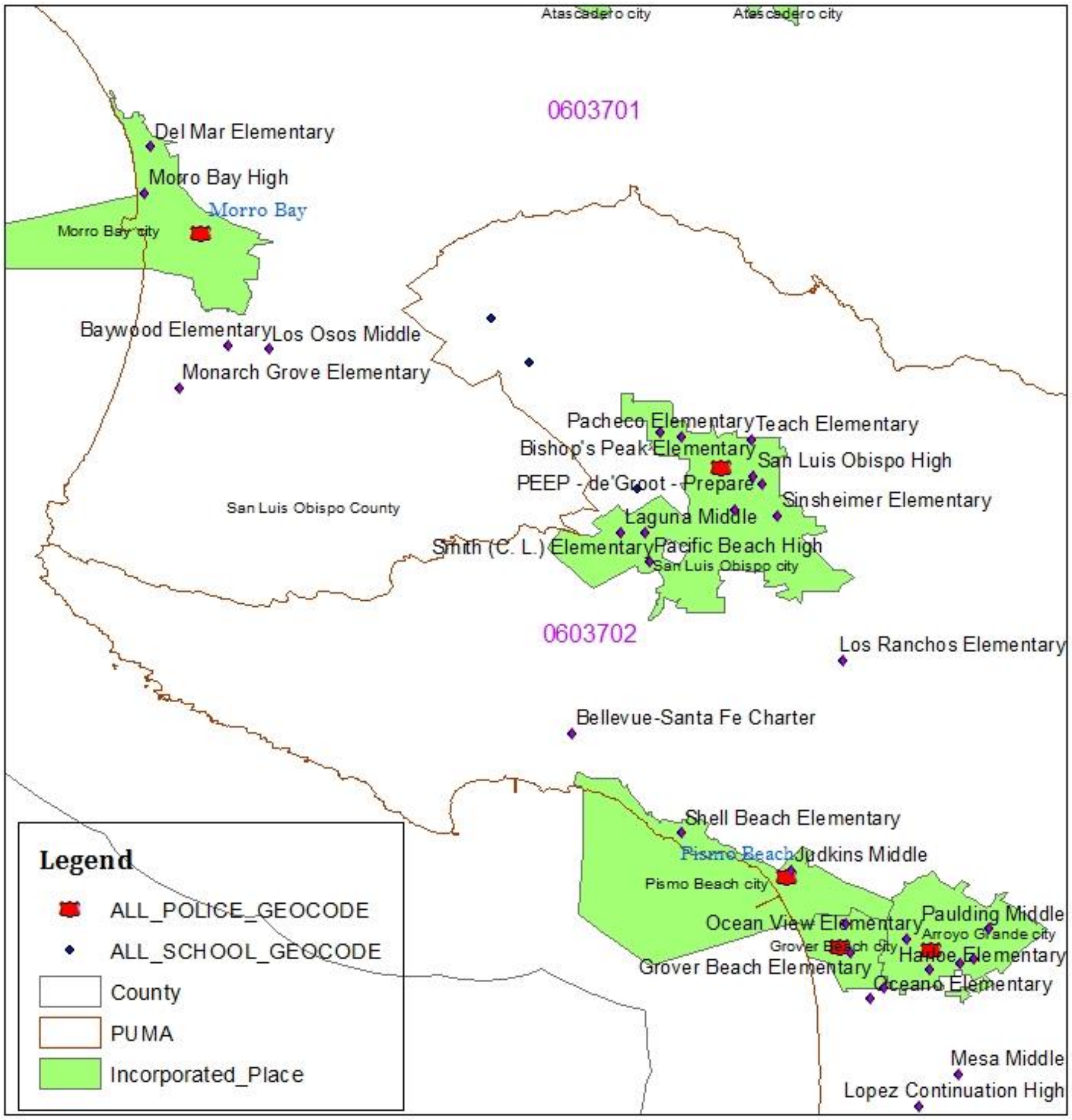
United States Department of Justice. Office of Justice Programs. Bureau of Justice Statistics. Law Enforcement Agency Indentifiers Crosswalk, 2012. ICPSR35158-v1. Ann Arbor, MI: Inter-university Consortium for Political and Social Research [distributor], 2015-04-17. http://doi.org/10.3886/ICPSR35158.v1

6. Appendix of Tables and Figures

6.1. Figure: Geographic Scope of California Statewide Education and Crime Data



6.2. Figure: Education, Crime, and IPUMS Data Match Example



6.3. Chart: Cohort Data Construction and CAHSEE Policy Timeline

Graduating Class Year	Data year 1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
2003	8	9	10	11	12											
2004		8	9	10	11	12										
2005			8	9	10	11	12									
2006				8	9	10	11	12								
2007					8	9	10	11	12							
2008						8	9	10	11	12						
2009							8	9	10	11	12					
2010								8	9	10	11	12				
2011									8	9	10	11	12			
2012										8	9	10	11	12		
2013											8	9	10	11	12	
2014												8	9	10	11	12

Year	Timeline of Significant Events
1999	Law passed imposing classes 2006+ to pass CAHSEE to earn diploma
2003	CAHSEE content standards adopted; State dropout definition modified
2005	Last class to take CAHSEE without consequence
2006	First class required to pass CAHSEE
2015	CAHSEE graduation requirement suspended

Chart Key	
	CAHSEE Test opportunity for classes required to pass for graduation
	CAHSEE Test opportunity for classes NOT required to pass for graduation
	2003 CAHSEE Content Standards imposed
	Treatment measured for cohort analysis
	Control variables measured

6.4. Table: Mean Values and Sample Sizes of Outcomes and Mediators for Full Sample and By Gun-Violence Exposure Level

Outcomes and CAHSEE Mediators	Full Sample				Violence Exposure Level				
					Low (g<-1)		High (g>=-1)		
	Mean	Std. Dev.	Student Subgroups	Grade 9 Student Years	Mean	Std. Dev.	Mean	Std. Dev.	High-Low Sig Diff.
Dropout Rates									
All (0/100)	10.54	12.62	39,719	4,164,371	5.39	8.74	12.56	13.35	***
Males (0/100)	11.60	13.46	37,585	4,156,547	5.93	9.35	13.83	14.22	***
Females (0/100)	9.21	11.93	36,182	4,146,144	4.64	8.27	11.00	12.66	***
CAHSEE Performance									
ELA Percent Passed (0/100)	77.15	16.53	28,338	3,772,193	85.68	13.84	73.70	16.19	***
Math Percent Passed (0/100)	75.15	20.43	28,395	3,777,069	84.53	16.92	71.14	20.50	***
ELA Mean Standard Score (0/100)	58.80	11.62	28,667	3,774,554	65.59	11.08	56.00	10.51	***
Math Mean Standard Score (0/100)	57.76	13.97	28,810	3,780,466	65.00	13.46	54.59	12.86	***

† p<0.10, * p<0.05, ** p<0.01, *** p<0.001

Table presents mean values weighted by grade nine enrolment counts. T-tests of significance are based simple regressions with grade nine enrolment weights. Standard errors are adjusted with clusters at the school level.

6.5. Table : Descriptive Values of Control Variables for Full-Sample and by Gun-Violence Exposure Level

	Full Sample		Violence Exposure Level				
			Low (g<-1)		High (g>=-1)		High-Low Sig Diff.
Control Measure	Mean	Std. Dev	Mean	Std. Dev	Mean	Std. Dev	
Student Characteristics							
Asian(0/1)	0.09	0.29	0.11	0.31	0.07	0.26	***
Hispanic (0/1)	0.52	0.50	0.33	0.47	0.59	0.49	***
African-American (0/1)	0.09	0.28	0.04	0.19	0.11	0.31	***
Pct. Receiving Free/Reduced Price Lunch (0/100)	44.16	26.58	24.24	20.67	52.78	24.10	***
Pct. Migrant Ed. Programs (0/100)	1.84	4.75	2.08	5.49	1.75	4.48	
Pct. In Gifted and Talented Program (0/100)	11.98	9.91	13.58	9.76	11.47	9.95	***
Pct. New students (0/100)	13.12	13.82	10.84	12.43	14.19	14.27	***
Parents Education							
Pct. Graduate Education (0/100)	10.65	11.41	17.40	14.36	7.89	8.41	***
Pct. College Graduates (0/100)	19.83	11.21	26.32	11.94	17.34	9.79	***
Pct. High School Graduates (0/100)	23.97	10.03	17.36	10.63	26.25	8.02	***
School Qualities							
Virtual School (0/1)	0.00	0.04	0.00	0.03	0.00	0.04	
Charter School (0/1)	0.06	0.23	0.01	0.12	0.08	0.26	***
Magnet School (0/1)	0.19	0.39	0.07	0.25	0.24	0.43	***
CAHSE Policy (0/1)	0.76	0.43	0.77	0.42	0.75	0.43	**
Traditional School (0/1)	0.88	0.33	0.85	0.36	0.88	0.32	
School Rank (1/10)	5.52	2.48	6.03	2.42	5.29	2.45	***
Pct. Teachers with Full Credentials (0/100)	90.24	9.42	93.95	5.94	88.79	10.01	***
Community Demographics							
Pct. Advanced Degree (0/1)	1.21	1.95	1.49	1.85	1.05	1.83	***
Pct. High School Graduates (0/1)	5.06	2.76	5.07	2.91	5.00	2.62	
Pct. Out of the labor market (0/1)	47.62	7.57	45.56	7.97	48.53	7.28	***
Pct. Employed or in Military(0/1)	44.47	8.20	47.45	8.42	43.10	7.82	***
Pct. Fatherless Households	22.22	10.85	17.75	6.64	24.27	11.66	***
Log Median Income (9.6/12.0)	10.89	0.39	11.17	0.37	10.77	0.34	***

† p<0.10, * p<0.05, ** p<0.01, *** p<0.001

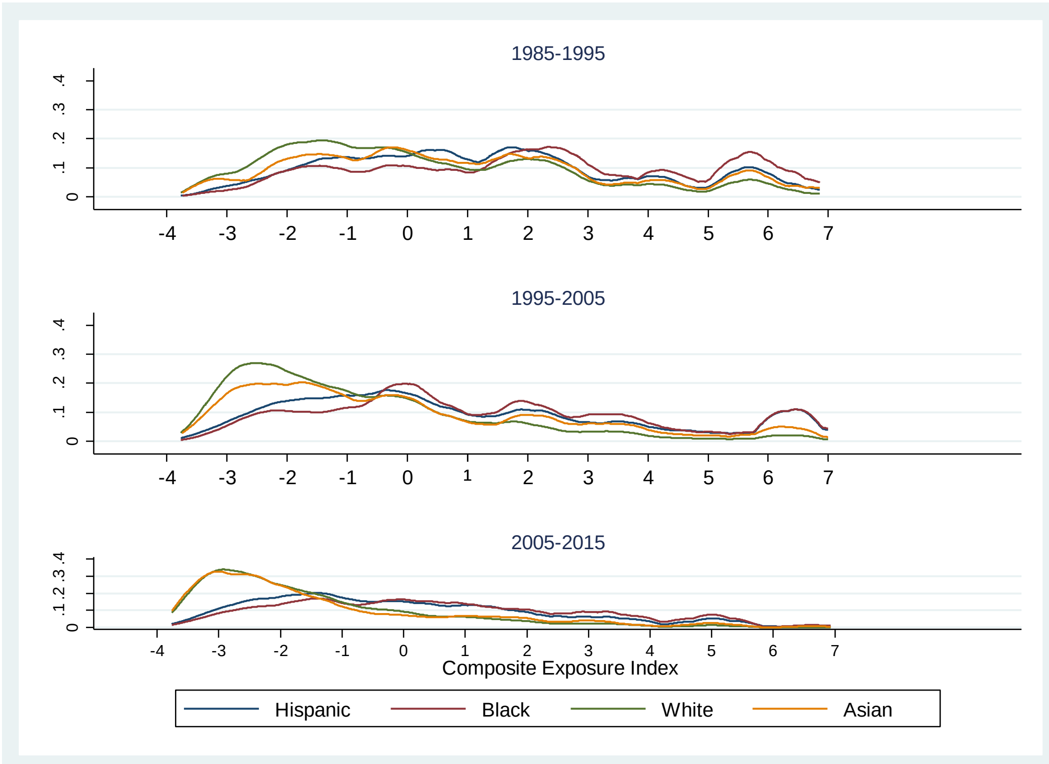
Table presents mean values weighted by grade nine enrolment counts. T-tests of significance are based simple regressions with grade nine enrolment weights. Standard errors are adjusted with clusters at the school level. Percentages for community demographics are multiplied by one hundred to achieve a (0/100) scale. Regression estimates use these variables the (0/1) scale.

6.6. Table Factor Loadings for Firearm Related Disturbances

Disturbance*	Factor 1	Factor 2
Homicide	0.837	0.043
Firearm Robbery	0.894	-0.024
Firearm Assault	0.901	-0.016

*All disturbances are measured per 100,000 individuals in a population. Loadings were estimated in STATA using a sample of 593,047 observations.

6.7. Figure: Composite Gun-violence Exposure over time by student racial group



6.8. Table: Composite Gun-violence Exposure over time by student racial group

	$\mu_{Group}(Composite\ Exposure)$				$\Delta = \mu_{group} - \mu_{White}$		
Period	Asian	Black	Hispanic	White	Asian	Black	Hispanic
1985-1995	5.45	10.40	7.67	2.13	3.33	8.27	5.54
1995-2005	1.18	3.68	2.79	-0.26	-0.95	3.94	3.06
2005-2015	-0.73	1.53	0.27	-1.31	-2.86	2.84	1.58
2015	-1.32	0.67	-0.33	-1.60	**-3.44**	**2.27**	**1.27**
Total Change	6.77	9.73	8.00	3.73	-	-	-

6.9. Table: University of California and California State University High School Course Requirements for Admissions Eligibility

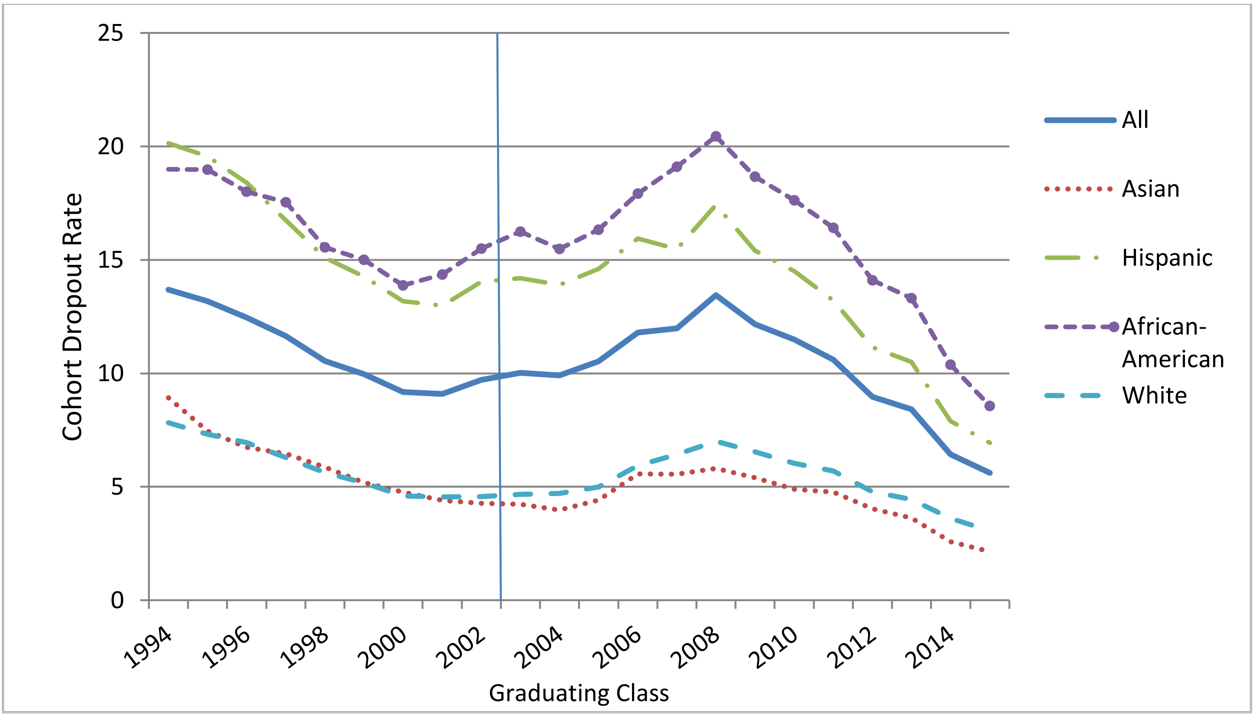
Area	CSU Requirement	UC Requirement	Years
a. History and Social Science	History and Social Science (including 1 year of U.S. history or 1 semester of U.S. history and 1 semester of civics or American government AND 1 year of social science)	Two years of history/social science, including: one year of world history, cultures and geography (may be a single yearlong course or two one-semester courses), and one year of U.S. history or one-half year of U.S. history and one-half year of civics or American government	2
b. English	English (4 years of college preparatory English composition and literature)	Four years of college-preparatory English that include frequent writing, from brainstorming to final paper, as well as reading of classic and modern literature. No more than one year of ESL-type courses can be used to meet this requirement.	4
c. Math	Math (4 years recommended) including Algebra I, Geometry, Algebra II, or higher mathematics (take one each year)	Three years (four years recommended) of college-preparatory mathematics that include the topics covered in elementary and advanced algebra and two- and three-dimensional geometry. Approved integrated math courses may be used to fulfill part or all of this requirement, as may math courses taken in the seventh and eighth grades if the high school accepts them as equivalent to its own courses.	3

d. Laboratory Science	Laboratory Science (including 1 biological science and 1 physical science)	Two years (three years recommended) of laboratory science providing fundamental knowledge in two of these three foundational subjects: biology, chemistry and physics. The final two years of an approved three-year integrated science program that provides rigorous coverage of at least two of the three foundational subjects may be used to fulfill this requirement.	2
e. Language other than English	Language Other than English (2 years of the same language; American Sign Language is applicable - See below about a possible waiver of this requirement)	Two years, or equivalent to the 2nd level of high school instruction, of the same language other than English are required. (Three years/3rd level of high school instruction recommended). Courses should emphasize speaking and understanding, and include instruction in grammar, vocabulary, reading, composition and culture. American Sign Language and classical languages, such as Latin and Greek, are acceptable. Courses taken in the seventh and eighth grades may be used to fulfill part or all of this requirement if the high school accepts them as equivalent to its own courses.	2
f. Visual and Performing Arts	Visual and Performing Arts (dance, drama or theater, music, or visual art)	One yearlong course of visual and performing arts chosen from the following: dance, drama/theater, music or visual art	1
g. College Prep. Elective	College Preparatory Elective (additional year chosen from the University of California "a-g"list)	One year (two semesters), in addition to those required in "a-f"above, chosen from the following areas: visual and performing arts (non-introductory-level courses), history, social science, English,	1

	advanced mathematics, laboratory science and language other than English (a third year in the language used for the "e" requirement or two years of another language)	
Total Required Courses		15

Source: CSU Requirements from CSU Mentor at https://secure.csumentor.edu/planning/high_school/subjects.asp . UC Requirements from UC Admissions at http://admission.universityofcalifornia.edu/freshman/requirements/a-g-requirements/ . Information accessed in October of 2015.

6.10. Cohort Level Dropout Rates Over Tim and By Race for California Public High School Students (Class of 1994-High School Class of 2014)

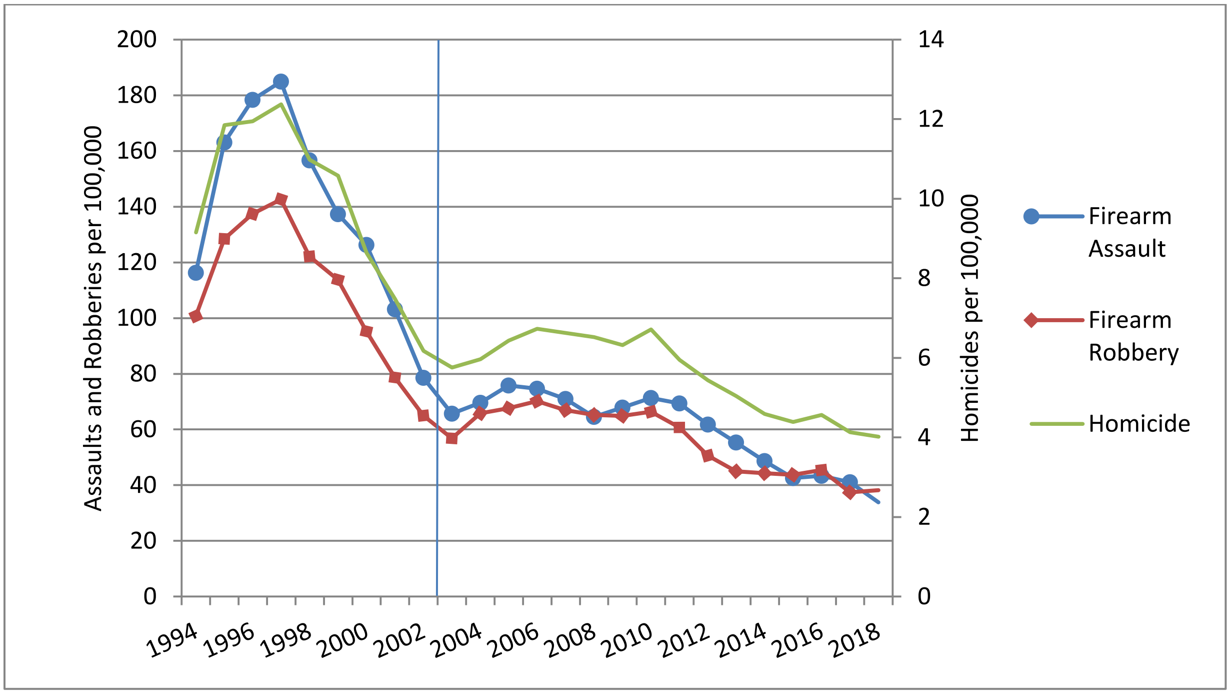


The veritical line denotes the beginning of the analysis sample with the class of 2003.

6.11. Table : Mean Dropout Rates for Student Subgroups, California High School Graduating Classes from 2003 to 2014

	Mean	Std. Err.	Group - White
All	10.18	0.01	-
African-American	16.11	0.02	10.81
Asian	4.41	0.01	-0.89
Hispanic	13.10	0.01	7.80
White	5.31	0.01	-

6.12. Figure: Eighth-Grade Gun-Crime Rates Per 100,000 for California High School Graduating Classes from 1994 to 2018.



6.13. Table: Cross-Sectional Regression Effects of Violence Exposure on Cohort-Level High School Dropout Rates for the Full Sample and by Gender

Covariates	Full Sample b/se		Male b/se		Female b/se	
Gun-Violence Exposure (-1/6.1)	1.568	***	1.817	***	1.294	***
	(0.345)		(0.382)		(0.311)	
Asian(0/1)	-1.949	**	-2.378	**	-1.636	**
	(0.689)		(0.762)		(0.628)	
Hispanic (0/1)	1.541	***	1.646	***	1.483	***
	(0.423)		(0.463)		(0.391)	
African-American (0/1)	-0.564		-0.500		-0.903	
	(1.480)		(1.586)		(1.383)	
Pct. Receiving Free/Reduced Price Lunch (0/100)	0.027	†	0.034	*	0.019	
	(0.014)		(0.016)		(0.013)	
Pct. Migrant Ed. Programs (0/100)	-0.093	*	-0.125	**	-0.061	†
	(0.037)		(0.040)		(0.034)	
Pct. In Gifted and Talented Program (0/100)	-0.112	***	-0.121	***	-0.101	***
	(0.022)		(0.024)		(0.020)	
Pct. New students (0/100)	0.179	***	0.186	***	0.169	***
	(0.040)		(0.042)		(0.038)	
Parent: Graduate Education (0/100)	-0.030		-0.033		-0.028	
	(0.019)		(0.020)		(0.017)	
Parent: High School Graduates (0/100)	-0.062	†	-0.070	*	-0.053	†
	(0.033)		(0.035)		(0.030)	
Parent: College Graduates (0/100)	-0.047	*	-0.045	*	-0.046	*
	(0.020)		(0.022)		(0.018)	
Community: High School Graduates (0/1)	0.502		-0.160		0.614	
	(3.251)		(3.542)		(3.052)	
Pct. Teachers with Full Credentials (0/100)	-0.087	**	-0.085	*	-0.092	**
	(0.034)		(0.037)		(0.031)	
Virtual School (0/1)	19.701	***	21.554	***	18.462	***
	(3.286)		(3.562)		(3.082)	
Charter School (0/1)	4.370	*	4.901	*	3.949	*
	(2.016)		(2.154)		(1.906)	
Magnet School (0/1)	2.484	**	3.120	***	1.915	**
	(0.785)		(0.863)		(0.708)	
CAHSEE Policy (0/1)	-0.190		-0.306		-0.163	
	(0.324)		(0.357)		(0.298)	
Traditional School (0/1)	-0.717		-0.774		-0.595	
	(0.522)		(0.573)		(0.466)	
School Rank (1/10)	-0.554	***	-0.596	***	-0.492	***
	(0.082)		(0.088)		(0.077)	

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Covariates		Full Sample b/se		Male b/se		Female b/se	
	Community: Advanced Degree (0/1)	4.504		3.712		4.837	
		(5.153)		(5.772)		(4.729)	
	Pct. Out of the labor market (0/1)	24.871	*	25.123	*	24.810	*
		(10.499)		(11.428)		(9.781)	
	Pct. Employed or in Military(0/1)	16.365	†	16.172		16.242	†
		(9.603)		(10.345)		(9.033)	
	Pct. Fatherless Households	15.094	**	14.941	**	15.384	***
		(4.680)		(5.054)		(4.335)	
	Log Median Income (9.6/12.0)	-2.623	***	-3.033	***	-2.134	**
		(0.787)		(0.878)		(0.702)	
	Constant	26.751	*	32.281	**	20.403	*
		(11.084)		(12.146)		(10.147)	
N	Schools	756		755		755	
	Student Subgroups	30,079		29,045		28,984	
	Student-years	3,877,529		3,873,005		3,871,343	
	p	0.000		0.000		0.000	

† p<0.10, * p<0.05, ** p<0.01, *** p<0.001

6.14. Table: Cross-Sectional Regression Effects of Violence Exposure on Cohort-Level High School Dropout Rate with Race x Exposure Interactions, Full Sample and by Gender

Covariates	Full Cohort b/se		Male b/se		Female b/se	
Gun-Violence Exposure (-1/6.1)	0.576		0.621		0.450	
	(0.353)		(0.387)		(0.322)	
Asian x Gun-Violence	-0.543	*	-0.546	†	-0.526	*
	(0.265)		(0.313)		(0.233)	
Hispanic x Gun-Violence	1.533	***	1.854	***	1.273	***
	(0.344)		(0.376)		(0.317)	
African-American x Gun-Violence	1.189	**	1.325	**	1.176	**
	(0.404)		(0.442)		(0.380)	
Asian(0/1)	-1.589	*	-1.904	*	-1.385	*
	(0.737)		(0.806)		(0.679)	
Hispanic (0/1)	1.668	***	1.812	***	1.584	***
	(0.423)		(0.462)		(0.393)	
African-American (0/1)	-0.159		-0.029		-0.543	
	(1.427)		(1.523)		(1.337)	
Pct. Receiving Free/Reduced Price Lunch (0/100)	0.025	†	0.032	*	0.018	
	(0.014)		(0.015)		(0.013)	
Pct. Migrant Ed. Programs (0/100)	-0.077	*	-0.104	**	-0.048	
	(0.036)		(0.040)		(0.034)	
Pct. In Gifted and Talented Program (0/100)	-0.110	***	-0.118	***	-0.099	***
	(0.021)		(0.023)		(0.020)	
Pct. New students (0/100)	0.179	***	0.186	***	0.169	***
	(0.040)		(0.042)		(0.038)	
Parent: Graduate Education (0/100)	-0.031	†	-0.034	†	-0.028	†
	(0.018)		(0.020)		(0.017)	
Parent: High School Graduates (0/100)	-0.050		-0.056	†	-0.043	
	(0.032)		(0.034)		(0.029)	
Parent: College Graduates (0/100)	-0.044	*	-0.041	†	-0.044	*
	(0.020)		(0.021)		(0.018)	
Community: High School Graduates (0/1)	1.300		0.760		1.335	
	(3.169)		(3.441)		(2.990)	
Pct. Teachers with Full Credentials (0/100)	-0.081	*	-0.078	*	-0.087	**
	(0.033)		(0.036)		(0.031)	
Virtual School (0/1)	19.473	***	21.273	***	18.278	***
	(3.270)		(3.542)		(3.070)	
Charter School (0/1)	4.624	*	5.202	*	4.173	*
	(2.006)		(2.139)		(1.900)	

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Covariates		Full Sample b/se		Male b/se		Female b/se	
	Magnet School (0/1)	2.362	**	2.968	***	1.825	*
		(0.784)		(0.857)		(0.712)	
	CAHSEE Policy (0/1)	-0.156		-0.264		-0.138	
		(0.319)		(0.350)		(0.293)	
	Traditional School (0/1)	-0.754		-0.819		-0.620	
		(0.520)		(0.572)		(0.464)	
	School Rank (1/10)	-0.551	***	-0.593	***	-0.490	***
		(0.081)		(0.086)		(0.076)	
	Community: Advanced Degree (0/1)	8.041		7.951		7.902	†
		(4.915)		(5.508)		(4.518)	
	Pct. Out of the labor market (0/1)	21.040	*	20.569	†	21.508	*
		(10.357)		(11.236)		(9.680)	
	Pct. Employed or in Military(0/1)	14.397		13.829		14.499	
		(9.433)		(10.145)		(8.883)	
	Pct. Fatherless Households	13.927	**	13.913	*	13.873	**
		(5.091)		(5.464)		(4.719)	
	Log Median Income (9.6/12.0)	-3.035	***	-3.473	***	-2.546	***
		(0.790)		(0.877)		(0.708)	
	Constant	32.900	**	38.955	**	26.461	**
		(10.987)		(12.008)		(10.081)	
N	Schools	756		755		755	
	Student Subgroups	30,079		29,045		28,984	
	Student-years	3,877,529		3,873,005		3,871,343	
	p	0.000		0.000		0.000	

† p<0.10, * p<0.05, ** p<0.01, *** p<0.001

6.15. Table: Total Effect Estimates of Gun-Violence Exposure on High School Dropout Rates for the Full Sample and by Gender

	Full Sample		Male		Female	
	b/se		b/se		b/se	
African-American	1.765	***	1.946	***	1.626	***
	(0.432)		(0.477)		(0.397)	
Asian	0.032		0.075		-0.076	
	(0.342)		(0.389)		(0.304)	
Hispanic	2.108	***	2.475	***	1.723	***
	(0.413)		(0.454)		(0.373)	
White	0.576		0.621		0.450	
	(0.353)		(0.387)		(0.322)	

† p<0.10, * p<0.05, ** p<0.01, *** p<0.001

6.16. Fixed Effect Estimates of Gun-Violence Exposure Effects on Dropout Rates using Within School Variation in Dropout Rates for Full Sample and by Gender

Covariates	Full Cohort b/se		Male b/se		Female b/se	
Gun-Violence Exposure (-1/6.1)	1.881	***	2.143	***	1.659	***
	(0.389)		(0.412)		(0.393)	
Asian(0/1)	-1.084	***	-1.741	***	-0.755	**
	(0.293)		(0.319)		(0.249)	
Hispanic (0/1)	2.045	***	2.240	***	2.191	***
	(0.252)		(0.312)		(0.248)	
African-American (0/1)	0.853	†	0.641		0.232	
	(0.440)		(0.529)		(0.417)	
Pct. Receiving Free/Reduced Price Lunch (0/100)	-0.132	***	-0.133	***	-0.132	***
	(0.012)		(0.014)		(0.011)	
Pct. Migrant Ed. Programs (0/100)	0.166	***	0.175	**	0.147	**
	(0.048)		(0.066)		(0.049)	
Pct. In Gifted and Talented Program (0/100)	-0.026	†	-0.028	*	-0.027	*
	(0.015)		(0.013)		(0.013)	
Pct. New students (0/100)	-0.040	**	-0.045	**	-0.034	**
	(0.012)		(0.014)		(0.011)	
Parent: Graduate Education (0/100)	-0.005		-0.012		-0.016	
	(0.014)		(0.013)		(0.012)	
Parent: High School Graduates (0/100)	-0.016		-0.019		-0.015	
	(0.011)		(0.013)		(0.011)	
CAHSEE Policy (0/1)	0.202		0.172		0.274	
	(0.327)		(0.326)		(0.292)	
School Rank (1/10)	-0.008		-0.011		0.020	
	(0.046)		(0.053)		(0.045)	

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Covariates		Full Sample b/se		Male b/se		Female b/se	
	Community: High School Graduates (0/1)	1.466		0.547		0.927	
		(1.353)		(1.651)		(1.335)	
	Pct. Out of the labor market (0/1)	-6.828	*	-6.350	†	-3.296	
		(3.186)		(3.631)		(3.165)	
	Pct. Employed or in Military(0/1)	-6.456	†	-6.586	†	-3.525	
		(3.342)		(3.570)		(3.592)	
	Pct. Fatherless Households	7.830	***	7.555	***	8.635	***
		(1.708)		(1.944)		(1.721)	
	Log Median Income (9.6/12.0)	0.083		-0.565		0.430	
		(0.499)		(0.625)		(0.487)	
	Constant	17.747	**	25.850	**	9.268	
		(6.257)		(7.885)		(6.252)	
N	Schools	756		755		755	
	Avg. Student Subgroups per School	39.84		38.47		38.39	
	Student-years	3,752,005		3,661,910		3,650,204	
	RMSE	7.29		8.28		7.36	
	R^2 Within	0.09		0.09		0.07	
	p	0.00		0.00		0.00	

† p<0.10, * p<0.05, ** p<0.01, *** p<0.001

6.17. Fixed Effect Estimates of Gun-Violence Exposure Effects on Dropout Rates with Race-Exposure Interactions using Within School Variation in Dropout Rates

	Full Cohort		Male		Female	
Covariates	b/se		b/se		b/se	
Gun-Violence Exposure (-1/6.1)	2.149	***	2.243	***	1.782	***
	(0.443)		(0.434)		(0.411)	
Asian x Gun-Violence	-1.566	***	-1.584	***	-1.277	***
	(0.242)		(0.305)		(0.200)	
Hispanic x Gun-Violence	-0.314		0.032		-0.106	
	(0.231)		(0.253)		(0.193)	
African-American x Gun-Violence	0.735	*	1.040	**	0.802	**
	(0.305)		(0.320)		(0.282)	
Asian(0/1)	-1.541	***	-2.240	***	-1.176	***
	(0.286)		(0.323)		(0.249)	
Hispanic (0/1)	1.825	***	1.955	***	1.993	***
	(0.233)		(0.294)		(0.230)	
African-American (0/1)	1.809	***	1.693	**	1.107	**
	(0.434)		(0.519)		(0.420)	
Pct. Receiving Free/Reduced Price Lunch (0/100)	-0.132	***	-0.133	***	-0.132	***
	(0.012)		(0.014)		(0.011)	
Pct. Migrant Ed. Programs (0/100)	0.166	***	0.176	**	0.147	**
	(0.049)		(0.067)		(0.050)	
Pct. In Gifted and Talented Program (0/100)	-0.026	+	-0.029	*	-0.027	*
	(0.015)		(0.012)		(0.013)	
Pct. New students (0/100)	-0.040	**	-0.045	**	-0.035	**
	(0.012)		(0.014)		(0.011)	
Parent: Graduate Education (0/100)	-0.005		-0.012		-0.017	
	(0.014)		(0.013)		(0.012)	
Parent: High School Graduates (0/100)	-0.016		-0.020		-0.015	
	(0.011)		(0.013)		(0.011)	
CAHSEE Policy (0/1)	0.197		0.168		0.271	
	(0.327)		(0.326)		(0.291)	

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Covariates		Full Sample b/se		Male b/se		Female b/se	
	School Rank (1/10)	-0.007		-0.010		0.021	
		(0.046)		(0.053)		(0.045)	
	Community: High School Graduates (0/1)	1.826		1.155		1.316	
		(1.334)		(1.631)		(1.327)	
	Pct. Out of the labor market (0/1)	-5.870	*	-5.319		-2.374	
		(2.966)		(3.360)		(2.908)	
	Pct. Employed or in Military(0/1)	-5.021		-4.723		-2.083	
		(3.095)		(3.314)		(3.276)	
	Pct. Fatherless Households	2.372		1.407		3.658	*
		(1.548)		(1.823)		(1.584)	
	Log Median Income (9.6/12.0)	-0.952	*	-1.812	**	-0.493	
		(0.468)		(0.586)		(0.458)	
	Constant	29.176	***	39.544	***	19.385	***
		(5.642)		(7.268)		(5.727)	
N	Schools	756		755		755	
	Avg. Student Subgroups per School	39.84		38.47		38.39	
	Student-years	3,752,005		3,661,910		3,650,204	
	RMSE	7.25		8.23		7.33	
	R^2 Within	0.1002		0.096		0.0796	
	p	0.00		0.00		0.00	

† p<0.10, * p<0.05, ** p<0.01, *** p<0.001

6.18. Total Effect Estimates of Fixed Effect Models with Race-Exposure Interactions for the Full Sample and by Gender

	Full Sample		Male		Female	
	b/se		b/se		b/se	
African-American	2.883	***	3.283	***	2.584	***
	(0.452)		(0.501)		(0.499)	
Asian	0.583		0.659		0.506	
	(0.411)		(0.451)		(0.372)	
Hispanic	1.835	***	2.275	***	1.676	***
	(0.363)		(0.399)		(0.367)	
White	2.149	***	2.243	***	1.782	***
	(0.443)		(0.434)		(0.411)	

† p<0.10, * p<0.05, ** p<0.01, *** p<0.001

6.19. Effects of Violence Exposure on Completed Years of High School Among High School Dropouts

Covariates	Full Cohort b/se		Male b/se		Female b/se	
Gun-Violence Exposure (-1/6.1)	-0.021		-0.026	*	-0.020	
	(0.013)		(0.013)		(0.014)	
Asian(0/1)	0.166	***	0.168	**	0.198	***
	(0.049)		(0.052)		(0.056)	
Hispanic (0/1)	0.067	**	0.051	†	0.098	***
	(0.025)		(0.027)		(0.029)	
African-American (0/1)	0.090		0.117		0.082	
	(0.067)		(0.073)		(0.077)	
Pct. Receiving Free/Reduced Price Lunch (0/100)	-0.006	***	-0.006	***	-0.005	***
	(0.001)		(0.001)		(0.001)	
Pct. Migrant Ed. Programs (0/100)	0.007	*	0.008	**	0.006	*
	(0.003)		(0.003)		(0.003)	
Pct. In Gifted and Talented Program (0/100)	-0.003	†	-0.002		-0.002	
	(0.001)		(0.001)		(0.001)	
Pct. New students (0/100)	-0.001		-0.001		-0.001	
	(0.001)		(0.001)		(0.001)	
Parent: Graduate Education (0/100)	0.001		0.001		0.000	
	(0.002)		(0.002)		(0.002)	
Parent: High School Graduates (0/100)	0.001		0.002		0.001	
	(0.002)		(0.002)		(0.002)	
Parent: College Graduates (0/100)	-0.001		-0.001		-0.001	
	(0.002)		(0.002)		(0.002)	
Community: High School Graduates (0/1)	-0.473	†	-0.570	*	-0.309	
	(0.250)		(0.281)		(0.312)	
Pct. Teachers with Full Credentials (0/100)	-0.001		0.000		-0.002	
	(0.002)		(0.002)		(0.002)	
Virtual School (0/1)	-0.584	***	-0.635	***	-0.497	***
	(0.101)		(0.105)		(0.097)	
Charter School (0/1)	-0.144	**	-0.166	**	-0.117	*
	(0.052)		(0.054)		(0.053)	

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Covariates		Full Sample b/se		Male b/se		Female b/se	
	Magnet School (0/1)	-0.073	*	-0.074	*	-0.067	*
		(0.031)		(0.033)		(0.030)	
	CAHSEE Policy (0/1)	0.165	***	0.160	***	0.195	***
		(0.022)		(0.023)		(0.024)	
	Traditional School (0/1)	0.044		0.037		0.036	
		(0.039)		(0.040)		(0.042)	
	School Rank (1/10)	0.001		0.004		0.001	
		(0.005)		(0.005)		(0.005)	
	Community: Advanced Degree (0/1)	-1.566	***	-1.608	***	-2.082	***
		(0.406)		(0.465)		(0.480)	
	Pct. Out of the labor market (0/1)	-0.304		-0.273		-0.133	
		(0.518)		(0.562)		(0.560)	
	Pct. Employed or in Military(0/1)	0.065		0.108		0.198	
		(0.505)		(0.549)		(0.542)	
	Pct. Fatherless Households	0.5107	*	-0.600	*	-0.395	
		(0.227)		(0.241)		(0.251)	
	Log Median Income (9.6/12.0)	0.009		-0.001		0.006	
		(0.055)		(0.057)		(0.062)	
	Constant	2.298	**	2.349	**	2.138	*
		(0.765)		(0.810)		(0.835)	
N	Schools	777		771		767	
	Student-years	3,657,825		3,502,365		3,378,957	
	p	0.000		0.000		0.000	

† p<0.10, * p<0.05, ** p<0.01, *** p<0.001

6.20. Effects of Violence Exposure on Completed Years of High School Among High School Dropouts with Race-Exposure Interactions

Covariates	Full Cohort b/se		Male b/se		Female b/se	
Gun-Violence Exposure (-1/6.1)	-0.027		-0.029		-0.016	
	(0.019)		(0.021)		(0.023)	
Asian x Gun-Violence	0.027		0.025		0.007	
	(0.024)		(0.027)		(0.030)	
Hispanic x Gun-Violence	0.000		-0.003		-0.010	
	(0.018)		(0.019)		(0.022)	
African-American x Gun-Violence	0.022		0.013		0.010	
	(0.021)		(0.023)		(0.025)	
Asian(0/1)	0.161	**	0.162	**	0.190	***
	(0.050)		(0.054)		(0.058)	
Hispanic (0/1)	0.069	**	0.052	†	0.097	**
	(0.025)		(0.027)		(0.030)	
African-American (0/1)	0.086		0.113		0.077	
	(0.067)		(0.072)		(0.075)	
Pct. Receiving Free/Reduced Price Lunch (0/100)	-0.006	***	-0.006	***	-0.005	***
	(0.001)		(0.001)		(0.001)	
Pct. Migrant Ed. Programs (0/100)	0.007	*	0.007	**	0.006	*
	(0.003)		(0.003)		(0.003)	
Pct. In Gifted and Talented Program (0/100)	-0.003	†	-0.002		-0.002	
	(0.001)		(0.001)		(0.001)	
Pct. New students (0/100)	-0.001		-0.001		-0.001	
	(0.001)		(0.001)		(0.001)	
Parent: Graduate Education (0/100)	0.001		0.001		0.000	
	(0.002)		(0.002)		(0.002)	
Parent: High School Graduates (0/100)	0.001		0.002		0.001	
	(0.002)		(0.002)		(0.002)	
Parent: College Graduates (0/100)	-0.001		-0.001		-0.001	
	(0.002)		(0.002)		(0.002)	
Community: High School Graduates (0/1)	-0.473	†	-0.571	*	-0.309	
	(0.250)		(0.282)		(0.313)	

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	Covariates	Full Sample b/se		Male b/se		Female b/se	
	Pct. Teachers with Full Credentials (0/100)	-0.001		0.000		-0.002	
		(0.002)		(0.002)		(0.002)	
	Virtual School (0/1)	-0.582	***	-0.633	***	-0.495	***
		(0.101)		(0.105)		(0.097)	
	Charter School (0/1)	-0.143	**	-0.165	**	-0.118	*
		(0.052)		(0.054)		(0.054)	
	Magnet School (0/1)	-0.070	*	-0.072	*	-0.065	*
		(0.031)		(0.033)		(0.030)	
	CAHSEE Policy (0/1)	0.164	***	0.160	***	0.194	***
		(0.022)		(0.023)		(0.024)	
	Traditional School (0/1)	0.046		0.039		0.037	
		(0.040)		(0.040)		(0.042)	
	School Rank (1/10)	0.001		0.004		0.001	
		(0.005)		(0.005)		(0.005)	
	Community: Advanced Degree (0/1)	-1.536	***	-1.597	***	-2.101	***
		(0.413)		(0.474)		(0.499)	
	Pct. Out of the labor market (0/1)	-0.292		-0.253		-0.111	
		(0.518)		(0.563)		(0.559)	
	Pct. Employed or in Military (0/1)	0.052		0.104		0.200	
		(0.504)		(0.548)		(0.541)	
	Pct. Fatherless Households	-(0.539)	*	-(0.613)	*	-(0.426)	
		(0.246)		(0.260)		(0.271)	
	Log Median Income (9.6/12.0)	(0.010)		(0.001)		(0.004)	
		(0.057)		(0.059)		(0.064)	
	Constant	(2.294)	**	(2.321)	**	(2.156)	*
		(0.789)		(0.836)		(0.857)	
N	Schools	777		771		767	
	Student-years	3,657,825		3,502,365		3,378,957	
	p	0.000		0.000		0.000	

† p<0.10, * p<0.05, ** p<0.01, *** p<0.001

6.21. Table: Total Effect Estimates on Dropout timing from Race-Exposure Interactions and Exposure Pure Effects Above

	Full Cohort		Male		Female	
	b/se		b/se		b/se	
African-American	-0.005		-0.015		-0.006	
	(0.017)		(0.017)		(0.019)	
Asian	0.000		-0.004		-0.010	
	(0.022)		(0.025)		(0.024)	
Hispanic	-0.027	†	-0.032	*	-0.026	†
	(0.015)		(0.016)		(0.016)	
White	-0.027		-0.029		-0.016	
	(0.019)		(0.021)		(0.023)	

† p<0.10, * p<0.05, ** p<0.01, *** p<0.001

6.22. Effects of Gun-Violence Exposure on Mediators

Mediator	b/se	
ELA Pct. Correct	-1.045	***
	(0.252)	
Math Pct. Correct	-1.596	***
	(0.266)	
ELA Std. Score	-0.502	***
	(0.135)	
Math Std. Score	-0.877	***
	(0.153)	

† p<0.10, * p<0.05, ** p<0.01, *** p<0.001

6.23. Table: Mediation Model Estimates: Direct Effects of Gun-Violence Exposure on Dropout Rate, Indirect Effects Through Mediators, and Proportion Mediated

Outcome	Mediator	Direct Effect of Exposure on Dropout Rate		Indirect Effect through Mediator		Percent Mediated
Full Sample Dropout Rate						
	ELA Pct. Correct	1.378	***	0.288	***	17.2%
		(0.338)		(0.072)		
	Math Pct. Correct	1.327	***	0.344	***	20.5%
		(0.326)		(0.062)		
	ELA Std. Score	1.395	***	0.270	***	16.1%
		(0.334)		(0.076)		
	Math Std. Score	1.295	***	0.377	***	22.5%
		(0.322)		(0.070)		
Male Dropout Rate						
	ELA Pct. Correct	1.642	***	0.302	***	15.5%
		(0.376)		(0.076)		
	Math Pct. Correct	1.581	***	0.369	***	18.9%
		(0.362)		(0.066)		
	ELA Std. Score	1.659	***	0.285	***	14.6%
		(0.371)		(0.080)		
	Math Std. Score	1.545	***	0.407	***	20.8%
		(0.358)		(0.076)		
Female Dropout Rate						
	ELA Pct. Correct	1.088	***	0.268	***	19.7%
		(0.303)		(0.067)		
	Math Pct. Correct	1.043	***	0.316	***	23.3%
		(0.293)		(0.057)		
	ELA Std. Score	1.105	***	0.250	***	18.4%
		(0.299)		(0.070)		
	Math Std. Score	1.017	***	0.345	***	25.3%
		(0.290)		(0.064)		

6.24. CAHSEE Policy Effects on High School Graduating Classes of 2004-2007

Covariates	Full Cohort b/se		Male b/se		Female b/se	
Gun-Violence Exposure (-1/6.1)	1.6284	***	1.8528	***	1.4005	***
	0.447		0.499		0.399	
Pct. UCCSU (0/1)	0.528		0.834		0.346	
	1.043		1.228		0.937	
Asian(0/1)	-1.420		-1.859	†	-1.079	
	(0.883)		(0.969)		(0.831)	
Hispanic (0/1)	2.050	***	2.059	***	2.061	***
	(0.532)		(0.593)		(0.489)	
African-American (0/1)	-0.211		-0.174		-0.463	
	(1.990)		(2.127)		(1.893)	
Pct. Receiving Free/Reduced Price Lunch (0/100)	0.064	**	0.075	**	0.052	**
	(0.021)		(0.023)		(0.019)	
Pct. Migrant Ed. Programs (0/100)	-0.227	***	-0.272	***	-0.180	***
	(0.059)		(0.066)		(0.053)	
Pct. In Gifted and Talented Program (0/100)	-0.103	***	-0.114	***	-0.088	***
	(0.029)		(0.032)		(0.026)	
Pct. New students (0/100)	0.079	***	0.082	***	0.074	***
	(0.022)		(0.023)		(0.020)	
Parent: Graduate Education (0/100)	-0.026		-0.019		-0.033	
	(0.027)		(0.030)		(0.025)	
Parent: High School Graduates (0/100)	-0.125	*	-0.126	*	-0.123	*
	(0.052)		(0.057)		(0.049)	
Parent: College Graduates (0/100)	-0.065	*	-0.057		-0.073	*
	(0.033)		(0.036)		(0.030)	
Pct. Teachers with Full Credentials (0/100)	-0.012		0.000		-0.027	
	(0.034)		(0.037)		(0.031)	
Virtual School (0/1)	13.965	***	15.432	***	12.040	***
	(1.379)		(3.556)		(1.300)	
Charter School (0/1)	3.463		3.877		3.220	
	(2.210)		(2.415)		(2.053)	
Magnet School (0/1)	2.456	*	3.047		1.902	†
	(1.110)		(1.194)		(1.030)	

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Covariates							
	CAHSE Policy (0/1)	1.112	**	1.138	**	1.041	***
		(0.339)		(0.376)		(0.312)	
	Traditional School (0/1)	-0.440		-0.353		-0.536	
		(0.605)		(0.665)		(0.555)	
	School Rank (1/10)	-0.687	***	-0.751	***	-0.611	***
		(0.097)		(0.108)		(0.088)	
	Community: Advanced Degree (0/1)	29.506	†	26.895		30.644	*
		(15.700)		(17.509)		(14.065)	
	Community: High School Graduates (0/1)	-51.008	**	-54.433	**	-51.296	***
		(16.833)		(18.863)		(15.318)	
	Pct. Out of the labor market (0/1)	19.426		17.482		23.432	*
		(12.255)		(13.524)		(11.385)	
	Pct. Employed or in Military(0/1)	12.498		10.661		15.961	
		(10.665)		(11.798)		(9.940)	
	Pct. Fatherless Households	16.478	**	16.709	*	16.828	**
		(6.280)		(6.774)		(5.918)	
	Log Median Income (9.6/12.0)	-3.722	***	-4.298	***	-3.118	***
		(0.987)		(1.100)		(0.892)	
	Constant	39.262	**	47.061	**	29.713	*
		(13.509)		(14.863)		(12.374)	
N	Schools	704		704		704	
	R^2	0.51		0.50		0.48	
	Student-years	1,335,935		1,334,289		1,334,551	
	RMSE	6.99		7.95		6.71	
	p	0.00		0.00		0.00	

† p<0.10, * p<0.05, ** p<0.01, *** p<0.001

6.25. CAHSEE Policy Interaction Total Effects and Proportion of Students Graduating Below State Standards.

	All		African-American		Asian		Hispanic		White	
	Policy total Effect	Below State Standard	Policy total Effect	Below State Standard	Policy total Effect	Below State Standard	Policy total Effect	Below State Standard	Policy total Effect	Below State Standard
	B/SE	Est	B/SE	Est	B/SE	Est	B/SE	Est	B/SE	Est
CAHSEE	1.112 **	1.250	1.716 *	2.069	1.309 ***	1.396	0.725	-	1.463 ***	1.568
	(0.339)		(0.725)		(0.347)		(0.505)		(0.214)	
CAHSEE x Exposure	-0.020	-	0.119	-	2.048 ***	2.200	-0.314	-	1.913 ***	2.060
	(0.534)		(0.709)		(0.593)		(0.529)		(0.471)	

† p<0.10, * p<0.05, ** p<0.01, *** p<0.001