Increasing adolescent firearm homicides and racial disparities following Florida's "Stand Your Ground" Self-Defense Law

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Abstract

Establishing whether specific laws impact rates of firearm homicide in adolescents is critical for identifying opportunities to reduce preventable adolescent death. We evaluated Florida's stand your ground law, enacted October 2005, using an interrupted time series design from 1999 to 2017. We used segmented quasi-Poisson regression to model underlying trends in quarterly rates of adolescent (15-19 years) in firearm homicide in Florida and disaggregated by race (Black/White). We used synthetic and negative controls (firearm suicide) to address time-varying confounding. Before Florida's stand your ground law, the mean quarterly rate was 1.53 firearm homicides per 100,000 adolescents. Black adolescents comprised 63.5% of all adolescent firearm homicides before and 71.8% after the law. After adjusting for trends, the law was associated with a 44.6% increase in adolescent firearm homicide. Our analysis indicates that Florida's stand your ground is associated with a significant increase in firearm homicide and may also exacerbate racial disparities.

What is already known on this subject

- Firearms are the second leading cause of death among adolescents and adolescent firearm homicide is on the rise
- Legalisation may be key in helping to reduce preventable adolescent death
- Florida's Stand Your Ground law is associated with a 32% increase in firearm homicides rates in adults but its impact on adolescent firearm homicide is unclear

What this study adds

- We found that Florida's Stand Your Ground law was associated with a 45% increase in adolescent firearm homicide
- This increase was driven by an increase in Black adolescent victims of homicide, accentuating racial disparities
- No equivalent increases were seen in our robustness checks; including a synthetic control and negative control analysis

Introduction

Firearms are the second leading cause of death among children and adolescents (1 to 19 years) in the United States.^{1,2} Homicide is the most common cause of pediatric firearm mortality at around 60% and becomes increasingly more common during adolescence (15 to 19 years).¹ In addition, rates of pediatric firearm death have increased by 44% in the past 5 years; mainly reflecting rising firearm homicide rates among adolescents.^{1,2}

Relative to other injury mechanisms (e.g, motor vehicles), fewer resources have been devoted to the substantial burden that constitutes adolescent firearm homicide.³ With limited funding, informative epidemiologic evidence is scant and includes few evaluations of the impacts of population-level interventions on adolescent firearm homicide. Thus, it remains unclear how current policies and laws may be impacting the problem.

Recent research has identified “stand your ground” (SYG) self-defense laws as contributing to the increasing burden of adult firearm homicides (20 years and over).⁴⁻⁷ SYG laws codify an individual’s right to use lethal force in self-defense from public situations in which threat is perceived, regardless of whether safely retreating from the situation might have been possible. A SYG law further grants “criminal immunity” to individuals who acted in self-defense.⁸ In October 2005, Florida made this extension to their self-defense law. Despite evaluations showing that Florida’s SYG law is associated with a 32% increase in firearm homicides rates among adults, a further 23 states have since enacted similar laws by statute.⁹

The laws have also been controversial as specific SYG cases have generated intense public and political debate. Advocates of the law argue that the increased threat of retaliatory violence deters predatory crimes, such as burglaries. Critics, on the other hand, argue that the laws serve to escalate aggressive encounters and exacerbate racial disparities in homicide where threats motivated by racial stereotypes produce unnecessary fatalities.^{4,10} Such concerns have been realised in a number of cases where individuals have attempted to avoid prosecution after fatally shooting young Black men, claiming that their actions were in ‘self-defense’ (e.g., Trayvon Martin, Jordan Davis, and Markeis McGlockton).

The effect of SYG laws on adolescent firearm homicides and racial disparities in adolescents has yet to be examined. We aimed to evaluate the impact of Florida's SYG law on patterns of firearm homicide among adolescents.

Methods

Study design

We used an interrupted time series (ITS) design to compare quarterly rates of adolescents homicide by firearms before and after the SYG came into effect on October 1, 2005.^{4,11} We used an ITS design as we considered the pre-intervention period, while controlling for time-varying confounding, to be the most appropriate source for estimating the counterfactual.¹¹ Our rationale for prioritising the pre-intervention period over the synthetic control stems from the observation that Florida is a unique US state in terms of its characteristics (e.g., southernmost location, tropical climate, and high homicide counts). Thus, the pool of potential comparison units (i.e., non-SYG states) used to derive the synthetic control are unlikely to be a representative sample of Florida in the absence of its SYG law. Using the pre-intervention period as the primary source to estimate the counterfactual enables automatic control of these time-invariant confounders (i.e., the unique Florida-specific characteristics), which we argue pose the more plausible threats to validity in this particular evaluation context than time-varying confounding from unexpected events co-occurring at the same time as the intervention (i.e., history bias).

Outcome

The main outcome was adolescent homicide by firearms in Florida. We used quarterly counts between January 1999 and December 2017 – obtained by special request from the Centers for Disease Control and Prevention’s Restricted Use Vital Statistics. Adolescents were defined as persons aged 15 to 19 years old at time of death. Homicide by firearms were identified using the ICD-10 codes for cause of death (*U01.4, X93-X95*).¹² Descriptive analyses were disaggregated by race (Black and White (including other races)) and reported as the mean quarterly ratio of Black-to-White firearm homicide. We also fitted separate ITS models for quarterly rates of Black and White (including other races) adolescent firearm homicides. Age-standardised rates were derived using yearly US Census Bureau population estimates for the age group 15 to 19 years.

Robustness checks

To check for time-varying confounding from co-occurring events (i.e., history bias), we included two robustness checks: (1) a synthetic control from 16 comparison states without SYG

laws (see supplementary material for full details);^{13–15} and (2) a negative control outcome of adolescent suicide by firearms in Florida (ICD-10 codes, *X72-X74*).^{4,16} Note that our use of a synthetic control adopts an indirect approach of identifying a ‘synthetic Florida’ time series, and then applying an ITS analysis to help rule out time-varying confounding in explaining the effect estimate.^{16,17} In addition, we selected adolescent suicide by firearms as the negative control as we hypothesised that this time series would be subject to the same potential time-varying confounders as adolescent homicide by firearms. Amongst others, these include changes to ICD codes or other reporting practices affecting the recording of mortality statistics, the availability of firearms, adolescent-specific changes (e.g., school exams, social media use), and levels of violence in Florida.

Data analysis

We examined whether trends in adolescent homicide by firearm before and after the enactment of the SYG law in Florida were significantly different. We used segmented quasi-Poisson regression analysis with harmonic terms to model, and control for, seasonal trends while estimating the effect of Florida’s SYG law. We modelled the potential effect of the law as immediate and permanent based on previous findings on the effect of Florida’s SYG law on adult homicides.^{4,5} All data analysis was conducted in R (version 3.5.2).

Results

Table 1 and Figure 1 show trends in adolescent homicide by firearms and the Black-to-White homicide ratio before and after Florida's SYG law.

Before Florida's Stand Your Ground Law

Between January 1999 and September 2005, Florida had a mean quarterly count of 16.44 adolescent homicides by firearms and a mean rate of 1.53 homicides per 100,000 adolescents. There were no increasing or decreasing underlying trends before the SYG law was enacted (Relative Risk (RR)=1.00; 95%CI=0.99-1.00; $p=0.7322$). During this period, 63.5% of homicides were Black adolescent victims. On average, twice as many Black adolescents died compared to White adolescents each quarter (Black-to-White homicide ratio: $M=2.05$; $SD=1.10$).

After Florida's Stand Your Ground Law

There was an abrupt step increase in adolescent homicide by firearms in the 12 years following the enactment of Florida's SYG law in October 2005. The mean quarterly count increased to 25.47 and the mean quarterly rate increased to 2.16 homicides per 100,000 adolescents. After controlling for underlying trends, we found an overall 44.6% increase in rates of adolescent homicide by firearm following the law's enactment ($RR=1.45$; 95%CI=1.17-1.79; $p=0.0006$). When disaggregating by race, we identified a 52.4% increase in Black adolescent firearm homicides ($RR=1.52$; 95%CI=1.18-1.96; $p=0.0010$) while a smaller 32.6% increase in White and other races adolescent firearm homicides ($RR=1.33$; 95%CI=0.93-1.90; $p=0.1231$). As a result, over three times as many Black adolescents died compared to White adolescents after Florida's SYG law was enacted (Black-to-White homicide ratio: $M=3.09$; $SD=1.68$).

Synthetic and negative controls

The synthetic control showed relatively good fit; it was comparable to Florida and superior to the mean of all comparison states (see supplementary material and Figure 2). The synthetic control showed no increasing or decreasing underlying trend and no significant increase in adolescent homicide by firearms following the enactment of Florida's SYG law ($RR=1.04$; 95%CI=0.86-1.26; $p=0.6553$). In addition, the negative control outcome of adolescent suicide

by firearms showed no significant change (RR=0.83; 95%CI=0.61-1.14; $p=0.2496$; see Figure 3).

Table 1. The impact of Florida's Stand Your Ground Law on rates of firearm homicide in adolescents (15-19 years)

Characteristic	Mean Quarterly Count (SD)		Mean Quarterly Rates per 100 000 Population (SD)		Relative Risk (95% CI)	
	Before	After	Before	After	Trend	SYG law (step change)
Outcome						
Adolescent firearm homicide in Florida	16.44 (4.67)	25.47 (5.96)	1.53 (0.42)	2.16 (0.51)	1.00 (0.99 – 1.00)	1.45 (1.17 – 1.79)***
Black (%)	63.47	71.77	..	..	..	..
White and other races (%)	36.53	28.23	..	..	..	..
Black-to-White ratio	2.05 (1.10)	3.09 (1.68)	..	..	..	..
Black adolescent firearm homicides in Florida	10.44 (3.64)	18.29 (5.12)	0.97 (0.32)	1.55 (0.44)	1.00 (1.00 – 1.01)	1.52 (1.18 – 1.96)**
White and other races adolescent firearm homicides in Florida	6.00 (2.56)	7.18 (3.10)	0.56 (0.25)	0.61 (0.27)	0.99 (0.99 – 1.00)	1.33 (0.93 – 1.90)
Controls						
Adolescent firearm homicide in synthetic control ^a	..	..	1.56 (0.36)	1.69 (0.40)	1.00 (1.00 – 1.01)	1.04 (0.86 – 1.26)
Adolescent firearm suicide in Florida	8.19 (2.82)	9.78 (3.76)	0.77 (0.28)	0.83 (0.32)	1.01 (1.00 – 1.01)*	0.83 (0.61 – 1.14)

SD = standard deviation; CI= confidence intervals; SYG = Stand Your Ground.

^a Because the synthetic control model matched on rates of adolescent firearm homicide, we used different model specifications in this ITS analysis as the outcome no longer followed a Poisson distribution. Instead, we directly model homicides rates using a segmented log-linked Gaussian generalized linear model and exponentiated the coefficients to obtain comparable estimates of relative risk (RR).

* $p < .05$; ** $p < .01$; *** $p < .001$

Discussion

Following the enactment of Florida's SYG law in October 2005, quarterly rates of firearm homicide in adolescents increased by 44.6%. This increase occurred despite a stable underlying trend before the law was implemented. On the other hand, our robustness checks showed no equivalent increases in adolescent firearm homicide in a synthetic control or adolescent firearm suicide in Florida (negative control), indicating that the effect estimate may not be explained by confounding from co-occurring events alone. These findings support the hypothesis that rates of adolescent firearm homicide increased as a result of enacting Florida's SYG law. They are also consistent with the 32% reported increase in rates of firearm homicide in adults in Florida.^{4,5}

We found preliminary evidence to suggest that the SYG law exacerbates racial disparities in homicide in Florida. During the 6 years before the law was implemented, two times as many Black as compared to White adolescents were fatally shot. This increased to three times as many Black adolescents after the law was implemented. Zero and low counts, that would yield low statistical power, prevented any formal difference-in-difference test of whether SYG laws affect adolescent homicide differentially by race. Even so, our findings replicate previous research showing that Florida's SYG law is associated with a quantifiable racial bias that aligns with racial stereotypes of threat.^{18,19}

Circumstances unique to Florida may have contributed to our findings, such as sociodemographic and cultural factors and other firearm laws. Having examined the impact of the SYG only in Florida, studies of stand your ground laws enacted in other states are warranted. We did not study the effects of the law on predatory crime, public safety, or firearm injuries, which warrant study as well.

Conclusion

Building on a critical need for public health research on pediatric firearm mortality, this study provides the first evaluation of the effects of a SYG law on firearm homicide among adolescents. Our analysis identified concerning increases in rates of adolescent firearm homicide in Florida. They also suggest that the law may accentuate racial disparities in adolescent homicide in Florida. Given the substantial burden of firearm homicide among adolescents, further investigating the impacts of SYG laws across the US is critical for identifying opportunities to reduce preventable adolescent death.

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