

**Critical Review Form
Therapy**

PGY-4

Goyal MK, Badolato GM, Patel SJ, Iqbal SF, Parikh K, McCarter R. State Gun Laws and Pediatric Firearm-Related Mortality. Pediatrics. 2019 Aug;144(2).

Objectives: “to test the hypothesis that stricter firearm legislation at the state level is associated with lower pediatric firearm-related mortality rates.” (p. 2)

Methods: This retrospective, cross-sectional study was conducted using data from the CDC's [Web-based Injury Statistics Query and Reporting System \(WISQARS\)](#) to determine the number of firearm-related deaths per year from 2011 to 2015, per state, for victims aged ≤ 21 years (except in states where the annual rate was < 10 , where counts were felt to be suppressed). Additionally, the strictness of each state's gun laws over for the same years was determined based on the [Gun Law Scorecards from the Brady Campaign to Prevent Gun Violence](#), which assigns score up to 100 (most strict) for each state. As these scores can be less than 0, they were adjusted based on the lowest scoring state such that the lowest possible score was 0 (meaning adjusted scores could be higher than 100). State level data from the 2011-2015 US census was used to determine each state's population, as well as race and ethnicity proportions, the proportion of population with a college education, and the percent living below the poverty line. Finally, gun ownership data from 2013 were obtained from [YouGov.com](#), a marketing research site, and states were dichotomized as low or high gun ownership based on the median value for all states.

The primary outcome was firearm related mortality in children and the primary exposure of interest was the Brady gun law score. Additionally, the impact of three specific laws on mortality rate was evaluated for three conditions: state law not present, law in effect < 5 years, and law in effect for 5 or more years. These three laws included: 1) universal background checks for firearm purchases, 2) universal background check for ammunition purchases, and 3) identification requirements for firearms (e.g. microstamping, ballistic fingerprinting).

Between 2011 and 2015 there were 21,241 firearm-related deaths among those 21 years of age or less, averaging 4250 deaths per year. The majority of these deaths were related to assault (61.6%) and occurred among males (87.3%). Most of these events occurred among those 18 to 21 years of age (68.7%).

Guide		Comments
I.	Are the results valid?	
A.	Did experimental and control groups begin the study with a similar prognosis?	
1.	Were patients randomized?	No. This was a purely observational study conducted

		using data obtained from multiple databases from 2011 to 2015. The primary exposure of interest in this study was the Brady gun law score, which was chosen <i>a priori</i> .
2.	Was allocation concealed? In other words, was it possible to subvert the randomization process to ensure that a patient would be “randomized” to a particular group?	N/A.
3.	Were patients analyzed in the groups to which they were randomized?	Patients were analyzed based solely on which state they were in when their firearm fatality occurred.
4.	Were patients in the treatment and control groups similar with respect to known prognostic factors?	There were no treatment and control groups, per se. Rather, the authors sought (primarily) to compare firearm fatality rates based on the restrictiveness of gun laws in the state in which the incident occurred. There may be additional, independent risk factors associated with each state that could affect the risk of a firearm fatality that would impact the results of this study and that were not accounted for.
B.	Did experimental and control groups retain a similar prognosis after the study started?	
1.	Were patients aware of group allocation?	N/A. This was an observational study in which patients were analyzed purely based on the state in which the event occurred. Blinding was neither possible nor relevant to the analysis.
2.	Were clinicians aware of group allocation?	N/A. See above.
3.	Were outcome assessors aware of group allocation?	N/A. See above.
4.	Was follow-up complete?	Presumably yes. While there was no specific follow-up in this study, all patients suffering a fatality due to a firearm injury in the US should be captured by the CDC database.
II.	What are the results ?	
1.	How large was the treatment effect?	<ul style="list-style-type: none"> • For every ten-point increase in the gun law score, there was a decrease in firearm-related mortality of 8%, with an unadjusted incident rate ratio (IRR) of 0.92 (95% CI 0.89 to 0.96). • Following adjustment for racial and ethnic proportions, education, poverty, and gun

		<p>ownership rates, there was a decrease in firearm-related mortality of 4% for every ten-point increase in the gun law score, for an adjusted IRR of 0.96 (95% CI 0.93 to 0.99).</p> <ul style="list-style-type: none"> • The presence of laws requiring universal background checks for firearm purchases in effect for 5 or more years was associated with a decrease in mortality, with an adjusted IRR of 0.65 (95% CI 0.46 to 0.90). • For the one state with a law requiring universal background checks for ammunition purchases (in effect < 5 years), there was an adjusted decrease in mortality compared to other states, with an adjusted IRR of 0.38 (95% CI 0.19 to 0.82).
2.	How precise was the estimate of the treatment effect?	See above.
III.	How can I apply the results to patient care?	
1.	Were the study patients similar to my patient?	Generally speaking, yes. We see a large number of firearm injuries at our institution and at St. Louis Children's Hospital, with a large number of associated deaths. The potential effects of gun laws here in Missouri would be entirely relevant to those living in this area.
2.	Were all clinically important outcomes considered?	No. The authors only looked at firearm-related mortality, which represent only a small fraction of the burden associated with firearm injuries in this country. Nonfatal injuries and the costs associated with care for these patients, as well as the psychological effects on victims, family, and friends, was not accounted for in this study.
3.	Are the likely treatment benefits worth the potential harm and costs?	Uncertain. While this study does seem to suggest a small association between the restrictiveness of state gun laws and firearm-related mortality, this does not necessarily confirm causation.

Limitations:

- 1. Mortality was the only outcome assessed, providing a rather limited view of the scope of disease.**
- 2. Despite purportedly evaluating pediatric firearm-related mortality, this study included patients up to 21 years of age and the majority of deaths analyzed occurred in adults aged 18 to 21.**

3. Gun ownership data was obtained from a marketing research website. This data was obtained from voluntary polling and is likely highly unreliable.
4. While this study suggests an associated between the restrictiveness of state gun laws and firearm-related mortality, this does necessarily represent [causation](#).

Bottom Line:

This retrospective cohort study found a significant associated between the restrictiveness of state gun laws and firearm-related mortality among those 21 years of age or less, with an adjusted IRR of 0.96 (95% CI 0.93 to 0.99). While this finding does not constitute causation, and additional [unanticipated confounders](#) may have influenced the results, it bears considering when legislatures consider additional state gun reform.