

Child Access Prevention Laws and Pediatric Firearm Injury: A Rapid Review

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PRiMER. 2024;8:37.

Published: 6/25/2024 | DOI: 10.22454/PRiMER.2024.120398

Abstract

Introduction: US child firearm fatality rates have risen since 2013. Child Access Prevention (CAP) laws aimed at reducing minors' access to firearms have existed since the 1980s. However, specific requirements for safe storage of firearms, standards of negligence, and penalties for offenders vary significantly by state, yielding a heterogeneous body of CAP legislation. A few studies have investigated the relative impacts of these laws on child firearm injury rates, with sometimes conflicting results. Here, we present a rapid review of the existing literature on CAP laws and their apparent impact on firearm-related injuries among US children, to assess whether CAP laws are an effective tool for reducing child firearm injuries.

Methods: We conducted a rapid review of published reports that evaluated the impact of CAP laws on pediatric firearm injuries and/or deaths in the United States. We extracted target population data and outcomes of each study. The data are presented narratively.

Results: A total of 14 articles met criteria for evaluation. Taken together, these studies showed that implementation of CAP legislation was associated with reduced pediatric firearm injuries and fatalities. Moreover, longitudinal or time-series studies that examined *changes* in pediatric firearm injuries pre/post-CAP legislation yielded the most consistent and robust findings.

Conclusion: CAP laws were found to be associated with reduced pediatric firearm injuries and deaths, with the magnitude of effect being proportional to CAP law stringency.

Introduction

Pediatric firearm injuries and fatalities have increased in the United States since 2013. In 2020, 4,368 children aged 19 and younger died of firearm-related injuries, the highest number in the previous 15 years and a 29% increase from 2019.¹ Roughly one-third of US households with children have firearms. Of those households, approximately 30% report storing all firearms unloaded and locked, while 20% report storing at least one firearm loaded and unlocked.² Greater firearm availability contributes to increased child deaths from firearm-related suicide, homicide, and unintentional injury.³ Firearm injuries are now the leading cause of death in US youth aged 0-24 years.^{1,4} This growing burden of US firearm deaths is an urgent public health crisis.

Since the 1980s, some states have sought to reduce child firearm access by regulating firearm storage practices and imposing liability on adults who enable unlawful access. Such child access prevention (CAP) laws have been enacted in 24 states and vary considerably in their terms.⁵ The most stringent CAP laws, referred to as “child could access” or “safe storage” laws, typically require safe firearm storage with felony penalties for violations. Less stringent CAP laws, referred to as “reckless provision” laws, only impose liability for directly providing firearms to minors, or when a minor accesses firearms to cause bodily injury or death.⁵

While some studies have shown associations between CAP legislation and reduced pediatric firearm mortality, the terms and reported efficacy of CAP laws vary considerably by state. Given recent and ongoing increases in pediatric firearm mortality, there is pressing need to determine whether and which CAP strategies are effective. Therefore, we conducted a rapid review of existing literature that examined the impact of CAP legislation on US pediatric firearm injuries and deaths. We hypothesized that studies with a longitudinal or temporal element (ie, those which compared pediatric firearm injury rates before and after CAP laws were adopted) would yield the most consistent results.

Methods

Data Sources and Search Strategy

This rapid review synthesizes the impact of CAP laws on pediatric firearm mortality in the United States. We conducted a PubMed literature search in January 2023 (with periodic updates until submission), using the search terms “CAP laws,” “firearm,” and “mortality.” All available publication years were considered for inclusion. The Boolean NOT terms “opioid” and “Medicaid” excluded literature beyond the scope of this review. Two independent reviewers performed a rapid, functional review of titles and abstracts to confirm relevance of the results. The search was limited to studies and reviews that examined US CAP laws written in English. Included studies met the following additional criteria:

1. Related to CAP laws or policy change;
2. Evaluation of statistics related to firearm-related injury and/or mortality in the pediatric and young adult populations (aged 0-24 years) within or across CAP law states; and
3. Peer reviewed publication in a relevant medical journal.

For each article we extracted location, population demographics, time frame, and summary outcomes data related to the impact of CAP legislation on pediatric firearm injuries and mortality, presented tabularly and narratively herein.

Results

The literature search identified 238 articles. Of those, 14 met all inclusion criteria (Figure 1). To test our hypothesis, we summarized and further categorized qualifying reports into those that assessed *changes* in pediatric firearm morbidity or mortality pre/post-CAP law passage (n=9, Table 1), versus those that made static assessments of associations between CAP legislation and pediatric firearm morbidity/mortality (n=5, Table 2). Table 3 summarizes the results of this analysis.

In our analysis, no (0/14) qualifying studies found CAP laws associated with *increased* pediatric firearm injuries, 11/14 (79%) of qualifying studies found CAP laws associated with *decreased* pediatric firearm injuries, 2/14 (14%) found mixed results, and 1/14 (7%) found no association (Table 3). However, the studies that analyzed *changes* in firearm morbidity/mortality before and after CAP legislation (Table 1) unanimously found that CAP laws were associated with *decreased* youth firearm injuries and/or deaths.

To illustrate, one nontemporal study found that compared to states with no CAP laws, states with strong CAP laws had *lower* pediatric firearm injuries, whereas states with weak CAP laws had *higher* pediatric firearm injuries – a mixed result (Table 2).⁶ In contrast, several pre/post studies found that stronger CAP laws were associated with greater reductions in youth firearm injuries/deaths (versus weaker CAP laws), and no pre/post study found weak CAP laws associated with *increased* firearm injuries (Table 1).^{5,7-10}

Discussion and Conclusions

In support of our hypothesis, studies that included a longitudinal or temporal element (ie, pre/post analysis of the legislative impact) were found to have the most consistent results (Table 3). Reasons that a non-pre/post analysis may generate spurious results include less firearm legislation, higher firearm ownership, and/or higher gun violence overall in the "weak CAP" versus "no CAP" states that were analyzed, as others discuss.⁶ Thus, while weaker CAP laws won't hurt and may help reduce pediatric firearm injuries, stronger CAP laws appear more effective.

Further highlighting the importance of pre/post study designs, others argue that longitudinal "difference in difference" studies—that is, "quasi-experimental research designs which estimate the effect of gun policies by comparing the pre–post change in suicide [firearm injury] rates among states that have adopted a gun policy (the treatment group) to the pre–post change in suicide [firearm injury] rates in comparable states that have not adopted that gun policy (the control group)"⁹—provide the best evidence of causal effects.^{9,11} Although proving causality is beyond the scope of this review, many studies in Table 1 and elsewhere¹¹ make credible arguments for causal effects of CAP and other firearm legislation on reducing pediatric firearm injuries.

Our rapid review has limitations. Our search was limited to studies indexed in PubMed, which comprises multiple databases (<https://pubmed.ncbi.nlm.nih.gov/about/>) that collectively should encompass most peer-reviewed health literature analyzing the impacts of CAP legislation on pediatric firearm morbidity/mortality. Thus, while some otherwise-qualifying studies not indexed in PubMed may have been missed, we don't believe such occurrences would impact our key findings. Our search terms ("CAP laws," "firearm," and "mortality") may not have identified all articles related to CAP laws and pediatric firearm injuries. A narrative review allows less robust quantitative analysis and conclusions versus a meta-analysis. Finally, the observed statistical relationships between CAP laws and firearm injury can vary by age group and study design, which may guide future research.

The results of our narrative review suggest that CAP legislation appears to be an effective tool for meaningfully reducing youth firearm injuries.

Tables and Figures

Figure 1: PRISMA Diagram

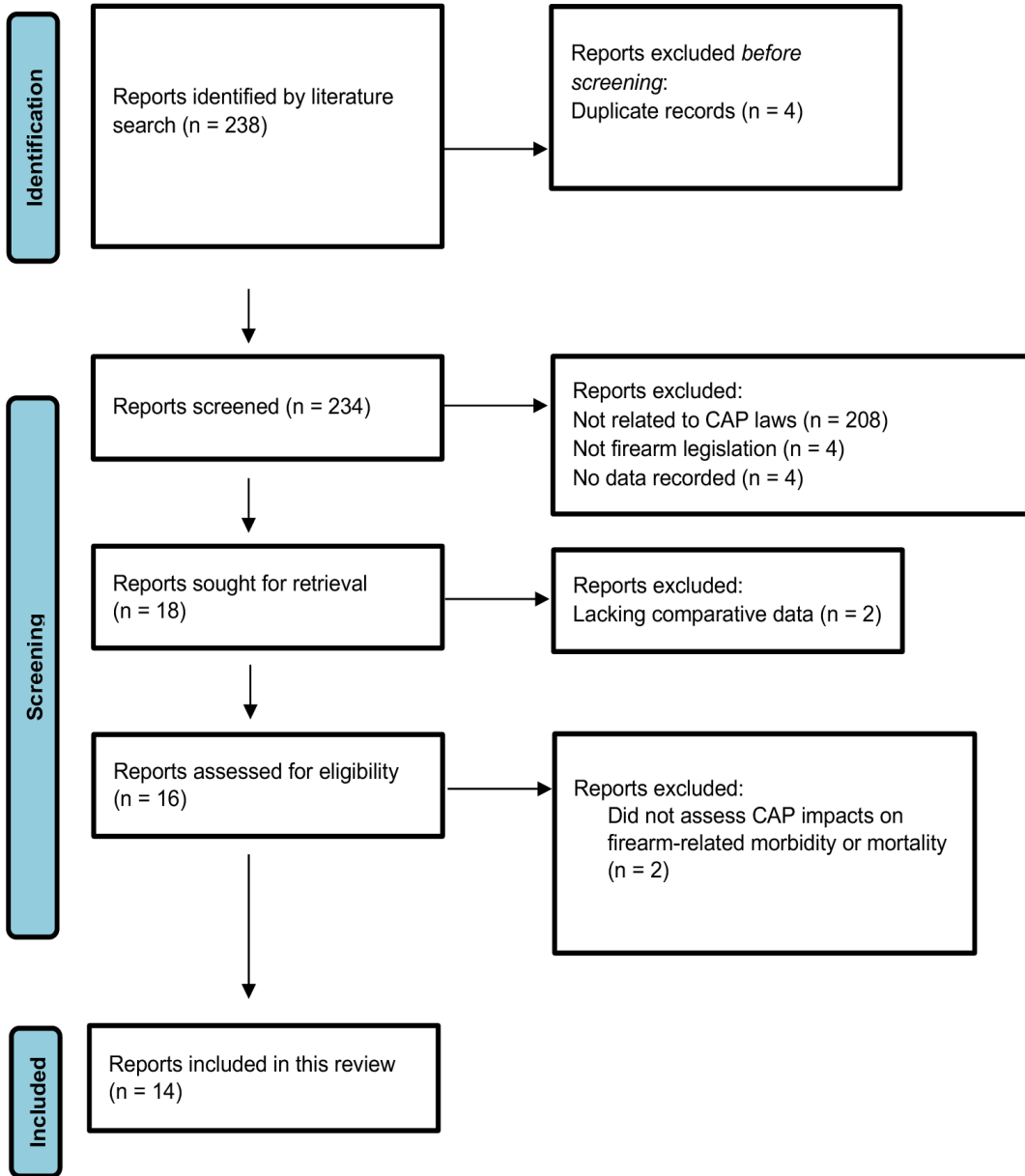


Table 1. Literature That Assessed Changes in Pediatric Firearm Morbidity or Mortality Pre/post CAP Law Passage

Study (year)	Location	Years examined	Population	Summary finding*	Outcomes of CAP legislation	Study design
Anderson et al. (2021) ⁷	26 US states, District of Columbia	1985-2013	Children, aged 12-17	Decrease	CAP laws were associated with a 19% reduction in child firearm homicide rates. The stringency of negligent storage laws was positively correlated to the strength of the estimated effect. CAP laws were not associated with adult firearm homicide rates nor with juvenile non-firearm homicide rates, "providing evidence that the relationship between CAP laws and juvenile firearm-related homicides is causal." ⁷	Time series event-study using Poisson regression analysis
Kappelman and Fording (2021) ⁹	41 US states	1981-2017	Young adults, aged 20-24	Decrease	Stringent CAP laws were associated with an 8% reduction in youth firearm suicide rate. The authors found support for these effects being causal. Weak CAP laws showed a negative but insignificant effect on youth firearm suicide rate.	Longitudinal study using negative binomial regression analysis
Kivisto et al. (2021) ¹⁰	United States	1991-2017	Children, aged 14-18	Decrease	Safe storage CAP laws were associated with a 13.1% reduction in self-inflicted firearm fatalities and an 8.7% reduction in non-firearm-related fatalities among children. Reckless provision CAP laws were not associated with child firearm fatality rates.	Ecological time series cross-sectional study employing fixed effect negative binomial regression analysis
Azad et al. (2020) ⁵	United States	1991-2016	Children, aged 0-14	Decrease	Stringent CAP laws – or negligence laws, with varying terms by state – were correlated with a 13% relative reduction in child firearm fatalities. Specifically, the largest effect was observed in child homicides by firearm (15% relative reduction). More stringent negligence laws ("child could access" laws ¹²) were associated with greater reductions in unintentional pediatric firearm deaths. Reckless provision CAP laws, which hold adult gun owners accountable for providing minors with firearms, did not reduce child firearm mortality.	Cross-sectional ecological panel (longitudinal) study with negative binomial regression analysis
Schell et al. (2020) ¹³	United States	1970-2016	All ages	Decrease	CAP laws were associated with a 6% reduction in firearm fatality rates. The observed effects were similar for all-cause firearm fatalities and firearm-related homicide and suicide. CAP laws had similar effects on fatality rates for the general population and minors.	Longitudinal study using negative binomial regression analysis and Bayesian estimation methods

Table 1: Continued

Study (year)	Location	Years examined	Population	Summary finding*	Outcomes of CAP legislation	Study design
Hepburn et al. (2006) ⁸	United States	1979-2000	Children, aged 0-14	Decrease	CAP laws were associated with reduced child fatality rates from unintentional firearm injury. Relative risk reduction was 22% for all CAP laws, and 36% for felony CAP laws. In contrast, CAP laws were not associated with unintentional firearm injury rates among adults aged 55-74.	Pooled cross-sectional time-series study with negative binomial regression analysis
Webster et al. (2004) ¹⁴	United States	1976-2001	Youth, aged 14-20	Decrease	In 14-17 year olds, firearm suicides decreased 10.8% following CAP law introduction, whereas no statistically significant association was observed between CAP laws and nonfirearm suicides, highlighting a possible causal relationship in this age group.	Time-series study with negative binomial regression analysis
Webster and Starnes (2000) ¹⁵	United States	1979-1997	Children, aged 0-15	Decrease	CAP laws were associated with a 17% reduction in child fatality rates due to unintentional firearm injury. The effects of CAP laws varied across states, with the most significant reduction in fatality rates observed in Florida.	Pooled time-series study with negative binomial regression analysis
Cummings et al. (1997) ¹⁶	United States	1979-1994	Children, aged 0-15	Decrease	CAP laws were associated with a 23% decrease in child mortality due to unintentional shootings. CAP laws were not statistically significant in firearm-related homicides and suicides but demonstrated modest declines.	Time series ecological study using Poisson and negative binomial regression models

Abbreviation: CAP, child access prevention.

Table 2. Literature That Made Static Assessments of Associations Between CAP Legislation and Pediatric Firearm Morbidity or Mortality

Study (year)	Location	Years examined	Population	Summary Finding*	Outcomes of CAP legislation	Study Design
Chammas et al (2023) ¹⁷	United States	1999-2019	Children, aged 0-18	Decrease	Over a 20-year period, states always having CAP laws, or with new CAP laws, had consistently lower pediatric firearm deaths compared to states never having CAP laws. The states with the ten highest pediatric firearm fatality rates within the study period were those that lacked CAP laws.	Pooled cross-sectional observational study
Price and Khubchandani (2022) ¹⁸	United States	2015-2019	Non-Hispanic Black youth, aged 0-19	No change	States with stringent CAP laws had significantly lower rates of child firearm fatalities, specifically among non-Hispanic Black youth, but the observed effect lost statistical significance after adjusting for poverty and firearm dealer density.	Pooled cross-sectional study
Madhavan et al (2019) ¹⁹	United States	2014-2015	Children, aged 0-19	Decrease	CAP laws were negatively correlated with pediatric firearm suicides, and this association remained significant after controlling for socioeconomic factors, registered firearms, and other firearm legislation.	Pooled cross-sectional study with correlation and linear regression analyses (nonlongitudinal)
Hamilton et al (2018) ⁶	44 US states	2006-2009	Children, aged 0-18	Mixed	Versus states with no CAP laws, strong CAP laws (that impose criminal liability for negligent storage) were associated with significant reductions in overall, self-inflicted, and unintentional pediatric firearm injuries; assault injuries trended down but were not significant. Versus states with no CAP laws, weak CAP laws (that only impose criminal liability for reckless provision) were associated with significant increases in overall, self-inflicted, unintentional, and assault pediatric firearm injuries.	Cross-sectional study with multivariate Poisson regression analysis (did not evaluate incidence of firearm injuries pre/post CAP legislation)
Lee et al (2013) ²⁰	44 US states	2006-2009	Children, aged 0-20	Mixed	CAP laws were associated with reduced unintentional and self-inflicted firearm injuries in the 0–12-year-old subgroup. CAP laws were associated with increased overall and assault firearm injuries in the full 0–20-year-old population; self-inflicted firearm injuries trended down in this full population ($P = .073$).	Pooled cross-sectional study with multivariate logistic regression analysis (nonlongitudinal)

Abbreviation: CAP, child access prevention.

Table 3. Comparison of Table 1 and Table 2 Trends in Pediatric Firearm Morbidity or Mortality

Summary finding*	Table 1 (pre/post CAP)	Table 2 (static CAP)	Totals (# reports)
Increase	0	0	0
Decrease	9	2	11
Mixed	0	2	2
No change	0	1	1
Totals	9	5	14

Abbreviation: CAP, child access prevention.

*For Tables 1-3, Summary Findings from articles are categorized as follows:

Increase: CAP Laws associated with a statistically significant increase in at least one measure of firearm mortality or morbidity in youth, with no measures decreased.

Decrease: CAP Laws associated with a statistically significant decrease in at least one measure of firearm mortality or morbidity in youth, with no measures increased.

Mixed: CAP Laws associated with an increase in at least one measure, and a decrease in at least one measure.

No Change: No statistically significant increases or decreases identified.

Acknowledgments

This work was supported by institutional funds from the State University of New York (SUNY) Upstate Medical University. This paper is subject to the SUNY Open Access Policy.

Presentations: An earlier version of this manuscript (substantial revisions have since occurred) was presented as a poster at the following conference poster sessions:

Charles Ross Memorial Student Research Day, March 29, 2023, Syracuse, NY

Binghamton Biomedical Research Conference, April 25, 2023, Binghamton, NY

Conflict Disclosure: The authors declare that they have no competing interests regarding this paper.

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