State Firearm Legislation and Nonfatal Firearm Injuries

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Objectives. We investigated whether stricter state-level firearm legislation was associated with lower hospital discharge rates for nonfatal firearm injuries.

Methods. We estimated discharge rates for hospitalized and emergency department–treated nonfatal firearm injuries in 18 states in 2010 and used negative binomial regression to determine whether strength of state firearm legislation was independently associated with total nonfatal firearm injury discharge rates.

Results. We identified 26 744 discharges for nonfatal firearm injuries. The overall age-adjusted discharge rate was 19.0 per 100 000 person-years (state range = 3.3–36.6), including 7.9 and 11.1 discharges per 100 000 for hospitalized and emergency department–treated injuries, respectively. In models adjusting for differences in state sociodemographic characteristics and economic conditions, states in the strictest tertile of legislative strength had lower discharge rates for total (incidence rate ratio [IRR] = 0.60; 95% confidence interval [CI] = 0.44, 0.82), assault-related (IRR = 0.58; 95% CI = 0.34, 0.99), self-inflicted (IRR = 0.18; 95% CI = 0.14, 0.24), and unintentional (IRR = 0.53; 95% CI = 0.34, 0.84) nonfatal firearm injuries.

Conclusions. There is significant variation in state-level hospital discharge rates for nonfatal firearm injuries, and stricter state firearm legislation is associated with lower discharge rates for such injuries. (*Am J Public Health.* 2015;105:1703–1709. doi:10.2105/AJPH.2015.302617)

Each year from 2005 to 2010, an average of 103 000 Americans were injured or killed by a firearm—approximately 282 individuals per day.[1] Most public attention and research has focused on fatal firearm injuries because they are a leading cause of injury death and account for more than 30 000 deaths annually.[1] Firearm injuries were the third leading cause of injury-related deaths in 2010 after poisoning and motor vehicle accidents and were the second most frequent cause of traumatic death related to a consumer product.[1,2] However, a majority of firearm-related injuries in the United States are nonfatal.[1,3,4] In 2010, nearly 5 individuals suffered nonfatal firearm injuries for every 2 who died as a result of firearm violence.[1] The age-adjusted fatal firearm injury rate in that year was 10.1 per 100 000 person-years, less than half of the age-adjusted nonfatal injury rate (24.0 per 100 000 person-years).[1] This high prevalence of nonfatal firearm injuries in the United States is associated with significant physical and psychological morbidity among injury survivors.[5–7] It is also a substantial economic burden for victims, taxpayers, and the United States.[8–12]

Numerous state and federal laws have been implemented in attempts to reduce firearm-related violence in the United States.[13] Household firearm ownership rates have been shown to be associated with states' rates of firearm-related suicides and homicides; thus, legislation might reduce firearm injuries by limiting overall firearm ownership.[14,15] A strong association has also been demonstrated between safer firearm storage practices and a lower risk of suicide and unintentional firearm deaths.[16–19] Hence, legislation aimed at increasing safe firearm storage may decrease firearm-related injuries, particularly in homes with children and adolescents. In addition, laws that promote background checks before firearm purchase and those that limit private firearm transactions and transfers may help limit firearm access by those most likely to harm themselves or others.

Overall, the effectiveness of these laws individually or as a whole remains unclear. Two studies evaluated the relationship between state firearm legislation and firearm injuries using measures of state firearm legislation on the basis of annual scorecards created by the Brady Center to Prevent Gun Violence.[20,21] These studies found lower rates of total firearm deaths, including homicides and suicides,[20] as well as lower rates of firearm injuries in children,[21] in states with more restrictive firearm legislation. Previous studies have also shown that laws related to background checks and limitations on handgun possession and transfer are associated with lower rates of firearm deaths, including suicides and homicides.[22–25] A study of the 1994 Brady Handgun Violence Prevention Act (Pub L. No. 103-159, 107 Stat. 1536, USC 921–922, HR 1025, 103rd Congress), which established a mandatory waiting period and background check requirement for handgun sales through licensed firearm dealers, found that the law led to a decline in the suicide rate for those aged 55 years and older, although these findings may have been driven by the implementation of the waiting period rather than the background check itself.[26]

Laws focused on preventing children's access to firearms are associated with lower rates of both unintentional deaths and suicides.[27,28] A cross-sectional, time series analysis of pooled data from 1979 to 2000 found that unintentional firearm deaths among children were declining nationally and that most states that enacted child access laws experienced greater declines in those injuries than did states that had not.[29] Notably, state-level comparisons of child access laws can be driven largely by the few states with the strictest child access legislation (e.g., felony conviction for violations).[29,30]

Additionally, several studies suggest that laws aimed at easing access to and use of firearms may be associated with higher rates of firearm injuries, including homicides.[31–33] One study found that the 2007 repeal of Missouri's permit to purchase law requiring firearm purchasers to obtain a license verifying that they passed a background check led to an increase in firearm-related homicides.[33] Conversely,

other studies have observed no association between stricter firearm laws and firearm violence,[26,34,35] and a recent systematic review of various federal and state firearm laws found insufficient evidence to determine their effectiveness in reducing firearm-related violence and injuries.[36]

Several studies have examined the relationship between firearm legislation and fatal firearm injuries, although little is known about the relationship between firearm legislation and nonfatal firearm outcomes.[37] This relationship may differ from that observed with fatal injuries because of the different circumstances under which nonfatal firearm injuries occur, including differences in the age of the injured,[1,3] the type of firearms involved,[38] and injury intent.[3] For instance, unintentional shootings are more likely to prove nonfatal than are intentional shootings, and a vast majority of self-inflicted injuries (i.e., suicide attempts) result in death.[3,39] Because of the higher prevalence of nonfatal firearm injuries, studies of nonfatal injuries may also have greater statistical power to determine associations between legislation and firearm outcomes that might not be observed in studies of fatal injuries.

We have described state variation in discharge rates for nonfatal firearm injuries in 2010 and determined whether stricter state-level firearm legislation was associated with lower discharge rates for nonfatal firearm injuries.

METHODS

For this ecological, cross-sectional study, we used data from 18 US states that reported discharge information to the Healthcare Cost and Utilization Project State Inpatient Databases[40,41] and the State Emergency Department Databases in 2010.[42]

The State Inpatient Databases and State Emergency Department Databases are censuses of discharge-level records for patients hospitalized in acute care facilities[41] and patients who were treated in emergency departments (EDs) without admission to inpatient facilities, respectively.[42] The State Inpatient Databases and State Emergency Department Databases provide a combined sample of more than 95% of all discharges from acute care and ED facilities in a particular state.[41,43]

For these analyses, we included discharges from individuals who were treated for a firearm injury in an inpatient or ED facility in 2010 and were discharged alive from that facility.

State Firearm Legislation

The exposure of interest was the strictness of state-level firearm legislation, which was assessed using 2009 state scorecards created by the Brady Campaign to Prevent Gun Violence.[44] We examined 2009 scorecards because they represented legislation that presumably would have been enacted before the period that we measured firearm outcomes.

The Brady Campaign assigns a score to each state on the basis of 28 possible classes of laws present, grouped into 5 broad categories of firearm legislation:

1. firearm trafficking,
2. background checks,
3. child access prevention,
4. limitations on military-style assault weapons, and
5. limitations on firearms in public places (data available as a supplement to the online version of this article at http://www.ajph.org).

We assigned states a single point for each class of law present. Potential scores range from 0 to 28; higher scores indicate stricter legislation.

Nonfatal Firearm Injury Discharge Rates

The primary outcome was the discharge rate for total nonfatal firearm injuries in each state in 2010. Secondary outcomes were discharge rates by intent of firearm-related injury, which we identified using External Cause of Injury Codes from discharge abstracts (assault-related [E965.0–0.4], self-inflicted [E955.0–0.4], unintentional [E922.0–0.3, 0.8, 0.9], and undetermined [E985.0–0.4]).[45]

We determined whether each event was nonfatal using disposition coding obtained from discharge abstracts.

State Characteristics

Using data from the 2010 US Census,[46] we abstracted several state-level characteristics on the basis of known or hypothesized associations with the exposure and outcomes, including median age, gender ratio, racial/ethnic composition (non-Hispanic White, non-Hispanic Black, Hispanic), percentage of population with a college degree, percentage of population living below the federal poverty level, and population density.

We abstracted the 2010 unemployment rate for each state from the US Bureau of Labor Statistics.[47]

Statistical Analysis

We categorized each discharge by intent of injury (assault related, self-inflicted, unintentional, or undetermined) and then quantified total discharges by summing hospitalized and ED-treated injuries in each state. We then used the standard age distribution of the 2010 US population to estimate age-adjusted rates of the primary and secondary outcomes by state. Before age adjustment, we used single imputation to account for missing age data (n = 75) on the basis of each subject's race, gender, insurance source, and injury intent.

To determine the association between strictness of state firearm legislation and the outcomes, we first categorized states into tertiles on the basis of their legislative scores (0–4, 5–14, 15–28). Because of the limited number of states available for this analysis, we used tertiles to avoid statistical power limitations that may have arisen from assessing legislative scores as a continuous exposure and to provide a more granular categorization than dichotomizing the exposure.

We then performed unadjusted and multivariable analyses, comparing nonfatal firearm injury discharge rates in states in the least strict tertile of firearm legislation to states in the second and third tertiles. We used negative binomial regression to report incidence rate ratios (IRRs) and their corresponding 95% confidence intervals (CIs), using the natural log of each state's 2010 population as an offset. In multivariable analyses, we included the following state-level covariates on the basis of expected confounding: median age, gender ratio, racial/ethnic composition, percentage of population with a college degree, percentage of population living below the federal poverty level, population density, and unemployment rate.

We used clustered robust SE estimates to account for dependence of observations within

TABLE 1—Discharges for Nonfatal Firearm Injuries in 18 US States: Healthcare Cost and Utilization Project State Inpatient Databases and State Emergency Department Databases, 2010

Injury Type	Total, No. (%)	Hospitalized,[a] No. (%)	Emergency Department,[b] No. (%)
Total	26 744 (100.0)	11 137 (41.6),	15 607 (58.4),
Assault related	14 679 (54.9)	7 530 (51.3)	7 149 (48.7)
Self-inflicted	1 012 (3.8)	659 (65.1)	353 (34.9)
Unintentional	9 240 (34.6)	2 420 (26.2)	6 820 (73.8)
Undetermined intent	1 813 (6.7)	528 (29.1)	1 285 (70.9)

Note. The 18 states studied were AZ, CA, FL, HI, IA, KY, MA, MD, NC, NE, NJ, NV, NY, RI, SC, UT, VT, and WI.
[a]Treated in an inpatient facility with or without previous emergency department visit.
[b]Treated and released from an emergency department.

each state. We then calculated the adjusted rate difference in total nonfatal firearm injury discharges between states with the least and most strict firearm legislation (reference group discharge rate × [adjusted IRR of strict firearm legislation group − 1]).

On the basis of hypotheses generated from previous studies,[20,24,27,28,30] we performed 2 additional analyses to determine the association between specific categories of firearm legislation and nonfatal firearm injury discharge rates. First, we used Brady scores specific to strengthening background checks (possible range = 0–8) and child firearm access prevention (possible range = 0–5) to dichotomize states as strict or nonstrict legislation states using the median score for each subcategory. We then assessed the independent associations between (1) strength of background check legislation and discharges for nonfatal firearm injuries, and (2) strength of legislation specific to child firearm access prevention and discharges for nonfatal firearm injuries among those aged 0 to 19 years. We used Stata version 12.0 (StataCorp LP, College Station, TX) for all analyses.

RESULTS

In the 18 states included in our analyses, we identified 26 744 discharges for nonfatal firearm injuries in 2010 (41.6% inpatient; 58.4% ED; Table 1). Fifty-five percent were assault related; 3.8%, 34.6%, and 6.7% were coded as self-inflicted, unintentional, and undetermined intent, respectively. Sixty-five percent of those with self-inflicted injuries were discharged from inpatient facilities, whereas a greater proportion of those with unintentional injuries and injuries of undetermined intent were treated and discharged from EDs (73.8% and 70.9%, respectively). The sociodemographic characteristics and injury intent of the study sample are available as a supplement to the online version of this article at http://www.ajph.org.

Nonfatal Firearm Injury Discharge Rates

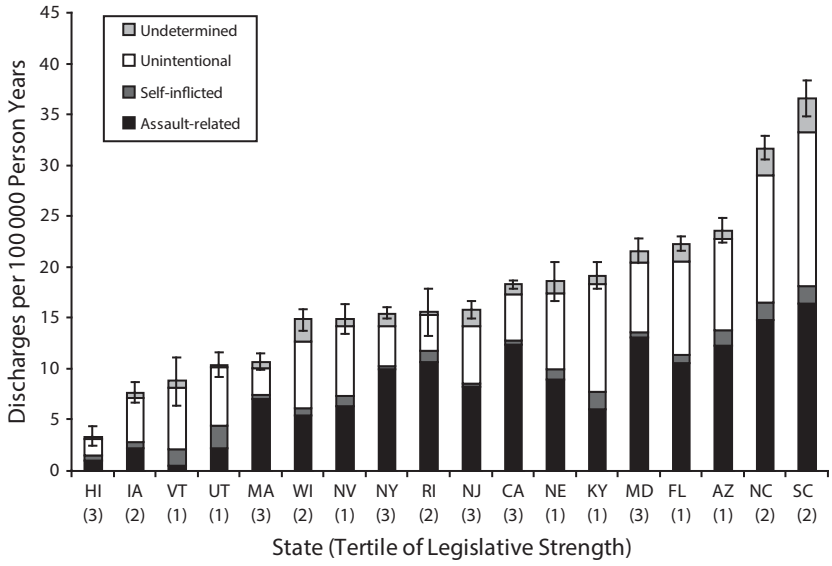
The overall age-adjusted discharge rate for nonfatal firearm injuries in 18 states in 2010 was 19.0 per 100 000 person-years, ranging from 3.3 per 100 000 (Hawaii) to 36.6 per 100 000 (South Carolina; Figure 1; data available as a supplement to the online version of this article at http://www.ajph.org).

The age-adjusted discharge rate for hospitalized and ED-treated nonfatal firearm injuries was 7.9 per 100 000 person-years (state range = 1.7–12.0) and 11.1 per 100 000 person-years (state range = 1.6–26.3), respectively. Discharge rates for nonfatal firearm injuries by intent are available as a supplement to the online version of this article at http://www.ajph.org.

State Firearm Legislation and Nonfatal Firearm Injury Discharge Rates

The median Brady score among the 18 states was 6 (possible range = 0–28, ranging from 0 in Utah to 24 in Massachusetts and New Jersey; Figure 1; data available as a supplement to the online version of this article at http://www.ajph.org).

In multivariable models adjusting for differences in state sociodemographic characteristics and economic conditions, states in the strictest tertile had a lower discharge rate for total (IRR = 0.60; 95% CI = 0.44, 0.82),



Note. Numbers in parentheses indicate tertile of legislative strength. Error bars = 95% confidence intervals for total nonfatal firearm injuries in each state.

FIGURE 1—Age-adjusted discharge rates for total nonfatal firearm injuries in 18 US states: Healthcare Cost and Utilization Project State Inpatient Databases and State Emergency Department Databases, 2010.

assault-related (IRR = 0.58; 95% CI = 0.34, 0.99), self-inflicted (IRR = 0.18; 95% CI = 0.14, 0.24), and unintentional (IRR = 0.53; 95% CI = 0.34, 0.84) nonfatal firearm injuries than did states in the least strict tertile of legislative strength (Table 2). States in the moderate tertile had a lower discharge rate for self-inflicted (IRR = 0.65; 95% CI = 0.53, 0.79) and unintentional (IRR = 0.77; 95% CI = 0.62, 0.97) nonfatal firearm injuries than did states in the least strict tertile of legislative strength. There was no relationship between strictness of state firearm legislation and discharge rates for injuries of undetermined intent.

Compared with states with the least strict firearm legislation (scores 0–4), the presence of stricter legislation (scores 15–28) was associated with 7.9 (95% CI = 3.5, 11.0) fewer discharges for nonfatal firearm injuries per 100 000 person-years, corresponding to 6229 (95% CI = 2800, 8717) fewer nonfatal firearm injury discharges in the 7 states with the strictest legislation in 2010.

Legislation Specific to Background Checks and Child Access Prevention

In multivariable models, states with strict laws had a lower discharge rate for total (IRR = 0.76; 95% CI = 0.62, 0.95) and unintentional (IRR = 0.71; 95% CI = 0.55, 0.93) nonfatal firearm injuries than did states with nonstrict laws regulating background checks (Table 3).

In multivariable models limited to discharges for those aged 0 to 19 years, states with strict laws had a lower discharge rate for self-inflicted (IRR = 0.52; 95% CI = 0.34, 0.81) and unintentional (IRR = 0.68; 95% CI = 0.51, 0.92) nonfatal firearm injuries than did states with nonstrict laws regulating child access prevention.

TABLE 2—Association Between Strictness of State Firearm Legislation and Discharges for Nonfatal Firearm Injuries in 18 US States in 2010: Healthcare Cost and Utilization Project State Inpatient Databases and State Emergency Department Databases, 2010

Firearm Legislation Score	Unadjusted Model, IRR (95% CI)	Adjusted Model,[a] IRR (95% CI)
Total nonfatal firearm injuries		
0–4 (Ref)	1.00	1.00
5–14	1.27, (0.76, 2.13)	0.92, (0.73, 1.16)
15–28	0.86, (0.57, 1.29)	0.60, (0.44, 0.82)
Assault-related nonfatal firearm injuries		
0–4 (Ref)	1.00	1.00
5–14	1.47, (0.76, 2.84)	1.01, (0.70, 1.45)
15–28	1.30, (0.73, 2.34)	0.58, (0.34, 0.99)
Self-inflicted nonfatal firearm injuries		
0–4 (Ref)	1.00	1.00
5–14	0.91, (0.59, 1.41)	0.65, (0.53, 0.79)
15–28	0.26, (0.19, 0.37)	0.18, (0.14, 0.24)
Unintentional nonfatal firearm injuries		
0–4 (Ref)	1.00	1.00
5–14	1.09, (0.65, 1.82)	0.77, (0.62, 0.97)
15–28	0.55, (0.39, 0.79)	0.53, (0.34, 0.84)
Undetermined nonfatal firearm injuries		
0–4 (Ref)	1.00	1.00
5–14	1.99, (1.02, 3.88)	1.64, (0.76, 3.51)
15–28	1.10, (0.69, 1.76)	1.17, (0.42, 3.27)

Note. CI = confidence interval; IRR = incidence rate ratio. The 18 states studied were AZ, CA, FL, HI, IA, KY, MA, MD, NC, NE, NJ, NV, NY, RI, SC, UT, VT, and WI. Classes of firearm laws include legislation related to firearm trafficking, background checks, child access prevention, limitations on military-style assault weapons, and limitations on firearms in public places. Potential scores range from 0 to 28; higher scores indicating stricter legislation.

[a]Adjusted for state characteristics, including median age, gender ratio, racial/ethnic distribution, percentage of population with a college degree, percentage of population living below the federal poverty level (2010 US Census), population density, and unemployment rate.

DISCUSSION

In this ecological, cross-sectional study, we identified nearly 27 000 discharges for nonfatal firearm injuries in 18 US states in 2010. There was 10 times the variation in overall discharge rates between states and similar variation by injury intent (e.g., assault related, self-inflicted). Stricter state-level firearm legislation was associated with lower discharge rates for total, assault-related, self-inflicted, and unintentional nonfatal firearm injuries.

To our knowledge, this is the first study to describe state variation in nonfatal firearm injury rates among the general population and the association between those rates and the strictness of state firearm legislation. Most studies to date have focused on the association of firearm legislation with fatal firearm injuries or other violent outcomes, such as aggravated assault or robbery,[36] and few studies have evaluated the association between comprehensive measures of legislation (e.g., the Brady score) and firearm outcomes. Previous studies of such legislation have focused mainly on remote handgun control laws (e.g., Gun Control Act of 1968 [Pub L. No. 90-618])[23,48] or have relied on transnational comparisons.[49,50] Our findings are consistent with a recent study that found lower rates of firearm-related homicides and suicides in states with stricter firearm legislation, which also were measured using the Brady score.[20]

Stricter state legislation specific to strengthening background checks before firearm purchase was associated with lower discharge rates for total and unintentional nonfatal firearm injuries and declines, although nonsignificant, in rates of all other nonfatal firearm injuries (assault related, self-inflicted, undetermined). These findings add to previous studies demonstrating a similar relationship between such laws and lower fatal firearm injury rates.[20,24,25]

We also studied the association between firearm legislation related to child access prevention and discharge rates for those aged 0 to 19 years. Stricter legislation was associated with lower discharge rates for self-inflicted and

unintentional nonfatal firearm injuries, the 2 types of firearm injuries primarily targeted through child access laws. These findings are consistent with several previous studies of fatal firearm outcomes.[21,27–30,37] We did not study the effect of child access prevention laws on adult firearm injuries. Presumably, laws mandating reduced firearm access among children and adolescents (e.g., safe storage) may also serve to reduce immediate firearm access by adults. Because of the strong association between firearm access and adult firearm injuries,[16,51,52] we might have observed an indirect effect of these laws on adult injuries.

These findings have implications beyond the physical and psychological impact of firearm injuries on survivors. Recent estimates have suggested that the societal cost of nonfatal firearm injuries in 2010 approached $20 billion, including approximately $430 000 and $120 000 for each hospitalized and ED-treated injury, respectively.[10,12] Included in these estimates are costs related to medical expenses, mental health services, work loss, and lost quality of life; lost quality of life is responsible for more than half of all costs. Most of this economic burden falls on taxpayers via costs directed toward Medicare, Medicaid, and the uninsured (data available as a supplement to the online version of this article at http://www.ajph.org).[10,12]

In multivariable analyses, we did not account for the proportion of each state's population that owned firearms, which has been shown to be associated with fatal firearm outcomes.[14,15] To our knowledge, no data regarding state-level firearm ownership are available for this period. Previous studies have used proxies to estimate this variable, such as the proportion of a state's total suicides that are committed using a firearm.[14,15] However, we hypothesized that one way firearm legislation may lower firearm-related injuries is by limiting the available pool of firearms. Thus, we did not include it in our models because we considered it a potential mediator of the relationship of interest.

We found no association between stricter state firearm legislation and injuries of undetermined intent. Firearm injuries are coded as undetermined when the underlying intent of the injury is unclear. Thus, they are misclassified by definition because of coding practices or lack of information regarding the injury event. Little is known about such injuries or the circumstances that lead to their misclassification. However, that we identified approximately 1800 undetermined firearm injuries in just 18 US states in a single year highlights the need to improve our understanding of these injuries, because they are clearly a significant source of morbidity and societal cost.

Because rates of fatal firearm injuries vary substantially at the state level,[1,20] that we observed similar variation in nonfatal injuries is not unexpected. Of interest, however, is that some states (e.g., Maryland) had higher discharge rates from inpatient than ED settings. Previous studies have demonstrated that assault-related injuries are more often hospitalized, likely because of their higher severity.[3] Thus, these differences may be partially driven by the proportion of each state's injuries that are assault related or overall injury severity. These between-state differences may also be related to differences in facility treatment volume and infrastructure. For instance, EDs that experience a high volume of firearm injuries (e.g., trauma centers) may be more accustomed to treating and discharging minor firearm injuries, whereas other facilities may be more likely to admit such patients.

TABLE 3—Strictness of State Firearm Legislation Specific to Background Checks and Child Access Prevention and Nonfatal Firearm Injury Discharges in 18 US States in 2010: Healthcare Cost and Utilization Project State Inpatient Databases and State Emergency Department Databases, 2010

Injury Type	Background Checks, IRR (95% CI)	Child Access Prevention,[a] IRR (95% CI)
Total nonfatal firearm injuries		
Nonstrict states (Ref)	1.00	1.00
Strict states	0.76 (0.62, 0.95)	0.79 (0.60, 1.03)
Assault-related firearm injuries		
Nonstrict states (Ref)	1.00	1.00
Strict states	0.76 (0.57, 1.02)	1.03 (0.77, 1.37)
Self-inflicted firearm injuries		
Nonstrict states (Ref)	1.00	1.00
Strict states	0.67 (0.44, 1.02)	0.52 (0.34, 0.81)
Unintentional firearm injuries		
Nonstrict states (Ref)	1.00	1.00
Strict states	0.71 (0.55, 0.93)	0.68 (0.51, 0.92)
Undetermined firearm injuries		
Nonstrict states (Ref)	1.00	1.00
Strict states	0.71 (0.43, 1.17)	0.54 (0.26, 1.14)

Note. CI = confidence interval; IRR = incidence rate ratio. The 18 states studied were AZ, CA, FL, HI, IA, KY, MA, MD, NC, NE, NJ, NV, NY, RI, SC, UT, VT, and WI. Adjusted for state characteristics, including median age, gender ratio, racial/ethnic distribution, percentage of population with a college degree, percentage of population living below the federal poverty level (2010 US Census), population density, and unemployment rate.
[a]Limited to injury discharges for individuals aged 0–19 years.

Limitations

There are limitations of this study to consider. First, although we observed a strong association between stricter firearm legislation and lower nonfatal firearm injury discharge rates, particularly for self-inflicted injuries, the ecological, cross-sectional design of this study limits our ability to determine causality and to comment on the effect of legislation on such injuries. Second, these results may be residually confounded by differences in state characteristics that we were unable to assess. Third, we measured state firearm legislation using the Brady score, a comprehensive scoring system that has been used in similar studies but not validated.[20,21,53] To our knowledge, there are no validated scales to compare firearm legislation between states, and although the Brady score assigns equal points to states on the

basis of the presence of similar laws, the implementation of those laws may vary.

Fourth, we may have underestimated total firearm injuries because the State Inpatient Databases and State Emergency Department Databases may not include discharge information from a small number of facilities that do not report data to the Healthcare Cost and Utilization Project,[43] and some firearm injuries may have been coded incorrectly. In addition, these databases do not capture individuals who suffered a nonfatal injury who did not seek medical treatment; although this scenario is likely exceedingly rare.[54] However, audits of Healthcare Cost and Utilization Project data have shown that a vast majority of injury discharges have associated External Cause of Injury Codes,[55] and we presume that miscoding injury discharges is unlikely for major events such as firearm injuries. Even before significant improvements in the quality of injury coding from 2001 to 2010,[55] Healthcare Cost and Utilization Project data have been shown to provide accurate estimates of firearm-related injuries nationally.[56] Although we analyzed data from only 18 states, our estimate of total nonfatal firearm injury discharges among them (19.0 per 100 000) is comparable to Centers for Disease Control and Prevention estimates of such injuries among 50 US states in the same year (23.6 per 100 000).[1]

Fifth, although the State Inpatient Databases and State Emergency Department Databases are designed to be mutually exclusive databases, there is potential for overlap in cases for which patients were transferred between separate facilities before hospital admission. Audits of Healthcare Cost and Utilization Project data have shown that this overlap is relatively minor (< 3%)[57] and would not account for the 10 times variation in discharge rates we observed between states. Lastly, these findings are vulnerable to misclassification bias because we could not identify injury victims who were transferred across state lines for treatment.

Conclusions

Nonfatal firearm injuries are a significant source of morbidity, health care utilization, and expenditures in the United States. We have demonstrated substantial variation in nonfatal firearm injury discharge rates between states, and we have shown that stricter state firearm legislation is associated with a lower discharge rate for such injuries. ■

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J. A. Simonetti drafted the article. J. A. Simonetti, A. Rowhani-Rahbar, and B. Mills were responsible for statistical analyses and interpretation. J. A. Simonetti, A. Rowhani-Rahbar, B. Young, and F. P. Rivara were responsible for the conceptualization and design of the study. A. Rowhani-Rahbar, B. Mills, B. Young, and F. P. Rivara were responsible for critical revision of the article for important intellectual content.

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Note. The content of this article is solely the responsibility of the authors and does not necessarily represent the official views of the Veterans Affairs Puget Sound Healthcare System or the HRSA.

Human Participant Protection

The institutional review board of the VA Puget Sound Healthcare System approved this study. This analysis of de-identified data did not require institutional review board approval by the University of Washington Human Subjects Division.

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