

**EMBARGOED until published by the American Journal of Public Health**

**DISCLAIMER: This manuscript is under an embargo by the American Journal of Public Health. It may not be published, released, or distributed prior to online publication by the Journal. The results of the study may not be reported by the media until the embargo date, which will be set by the Journal.**

**Easiness of Legal Access to Concealed Firearms Permits and Homicide Rates in the US  
States**

Michael Siegel, MD, MPH, Ziming Xuan, ScD, SM, MA, Craig S. Ross, PhD, MBA, Sandro  
Galea, MD, DrPH, MPH, Bindu Kalesan, PhD, MPH, MSc, Eric Fleegler, MD, MPH, and  
Kristin A. Goss, PhD, MPP

*American Journal of Public Health* (in press)

©*American Journal of Public Health*, 2017

1 **Abstract**

2 *Objectives.* To examine the relation of “shall issue” laws, in which permits must be issued if  
3 requisite criteria are met, “may issue” laws, which give law enforcement officials wide  
4 discretion over whether to issue concealed firearm carry permits or not, and homicide rates.

5 *Methods.* We compared homicide rates in “shall issue” and “may issue” states and total,  
6 firearm, non-firearm, handgun, and long gun homicide rates in all 50 states during the 25-  
7 year period 1991-2015. We included year and state fixed effects and numerous state-level  
8 factors in the analysis.

9 *Results.* “Shall issue” laws were significantly associated with 6.5% higher total homicide  
10 rates, 8.6% higher firearm homicide rates, and 10.6% higher handgun homicide rates, but  
11 were not significantly associated with long gun or non-firearm homicide.

12 *Conclusions.* “Shall issue” laws are associated with significantly higher rates of total,  
13 firearm-related, and handgun-related homicide.

14 Firearm violence is a major public health problem. In 2015, there were approximately  
15 36,000 firearm-related deaths in the United States; 13,463 were homicides, 22,018 were  
16 suicides, and 489 were unintentional injuries.<sup>1</sup> During the same year, 72.9% of homicides  
17 were firearm homicides<sup>1</sup> and of these, approximately 90% were committed using a handgun.  
18 A central question in the debate about public policies to reduce firearm violence is whether  
19 easier access to concealed handguns increases or decreases the rate of firearm-related  
20 homicides.<sup>2</sup> Some have argued that the feared or actual presence of armed citizens may deter  
21 violent crime.<sup>3</sup> Others have suggested that a higher prevalence of people carrying guns will  
22 increase the likelihood that an altercation results in a fatality.<sup>4</sup> Thus, having a clear  
23 understanding of the impact of concealed carry laws on firearm-related homicide would help  
24 guide policy makers aiming to reduce firearm violence.

25 As of the end of 2015, all states allowed certain persons to carry concealed handguns,  
26 but there were three major variations in permitting policy<sup>5</sup> (Table 1). In nine states, law  
27 enforcement officials have wide discretion over whether to issue concealed carry permits;  
28 these are referred to as “may issue” states. In 32 states, there is little or no discretion; these  
29 are referred to as “shall issue” states because permits must be issued if requisite criteria are  
30 met. In an additional nine states, there is no permit necessary to carry a concealed handgun;  
31 these are referred to as “permitless carry” states. The wide variation in these policies between  
32 states and over time presents the opportunity to compare homicide rates between states with  
33 varying concealed carry permitting policies to examine the impact of concealed carry laws on  
34 homicide.

35 The critical difference between “may issue” and “shall issue” laws is that in “may  
36 issue” states, law enforcement officials may use their judgment in making decisions about

37 whether to approve or deny a permit application, while in “shall issue” states, no judgment is  
38 involved—the application must be approved unless the applicant is categorically prohibited  
39 from concealed handgun possession. In “may issue” states, the element of discretion allotted  
40 to law enforcement is typically a judgment regarding the “suitability” or “need” of a person  
41 to carry a concealed weapon (Table 2). Law enforcement officials have a wide degree of  
42 latitude in making these judgments. In “shall issue” states, the categorical prohibitions  
43 consist of a list of specific criminal convictions.

44       Unfortunately, the existing literature on the impact of concealed carry laws is  
45 inconsistent. At least 10 national studies have examined the relationship between “shall  
46 issue” concealed carry laws and firearm-related or total homicide rates at the state level  
47 (Supplemental Table 1).<sup>6-15</sup> In two studies, “shall issue” laws were found to decrease  
48 homicide rates.<sup>6,7</sup> In two studies, these laws were found to increase homicide rates.<sup>8,9</sup> Six  
49 studies reported no clear impact of “shall issue” laws on homicide rates.<sup>10-15</sup> The  
50 inconsistency of these results has understandably created some confusion about what  
51 approach is most effective to address the firearm violence problem.

52       Most of the published literature on this topic includes data that are more than a  
53 decade old: the most recent year of data analyzed was 2010, and only three of the 10 studies  
54 examined data past the year 1998 (Supplemental Table 1). Since 1998, eleven additional  
55 states have enacted “shall-issue” laws.<sup>5</sup> This provides more variation over time and a longer  
56 follow-up period to examine this research question. Moreover, Ayres and Donohue<sup>16</sup> and  
57 Hepburn et al.<sup>12</sup> have suggested that the relationship between concealed carry laws and  
58 homicide rates may have been different during the period before and after the early 1990s. In  
59 addition, studies that included homicide rates from before 1994 were examining a trend that

60 was increasing, while studies examining homicide rates after 1994 were capturing declining  
61 trends. For these reasons, a re-examination of this research question using more recent data is  
62 needed.

63 One limitation of the existing literature is that no previous paper has examined the  
64 specific impact of concealed carry laws on handgun vs. long gun homicide rates. This is  
65 important because if such laws increase homicide by making it easier for people at high risk  
66 of violence to carry handguns, this effect should only be observed in relation to handgun-  
67 related homicides, not homicides committed with long guns. On the other hand, if permissive  
68 concealed carry laws deter crime by generating fear among potential perpetrators of  
69 encountering an armed individual, then all crime including handgun, long gun, and non-  
70 firearm homicide should decrease.

71 Another limitation of prior studies is that nearly all of them used linear models.  
72 However, homicide rates represent count data and the distribution of homicide rates across  
73 states is highly skewed<sup>17</sup> (Supplemental Figure 1). Plassmann and Tideman argued that a  
74 count model (such as a Poisson or negative binomial model) is the most reliable for  
75 analyzing crimes, such as homicides, with low occurrence rates.<sup>17</sup> Beyond the Plassmann and  
76 Tideman study, only one other study<sup>12</sup> used a count model.

77 In this paper, we examine the relationship between “shall issue” concealed carry laws  
78 and total, firearm-related, and non-firearm-related homicide rates, as well as handgun vs.  
79 long gun homicide rates across all 50 states during the 25-year time period 1991-2015 using  
80 both count and linear regression models. We examine the specificity of the relationship  
81 between concealed carry laws and homicide rates by separately modeling firearm vs. non-  
82 firearm homicide rates and then within firearm-related homicides, by modeling handgun vs.

83 long gun homicide rates. We analyze the relationship between “shall issue” concealed carry  
84 laws and homicide rates using both a count and a linear regression model, thus examining the  
85 robustness of results to the type of model used.

86

## 87 **METHODS**

### 88 **Design Overview**

89 The study used a quasi-experimental, panel design, taking advantage of changes in  
90 state concealed carry permitting laws over time in order to explore the relationship between  
91 these laws and total, firearm-related, and non-firearm-related homicide rates in the 50 states  
92 over a 25-year period, 1991-2015. We modeled homicide rates in two ways: (1) using a  
93 negative binomial regression with homicide rates as the outcome variable; and (2) using  
94 linear regression with log-transformed homicide rates as the outcome variable. In both cases,  
95 we included year and state fixed effects and controlled for a range of time-varying, state-  
96 level factors.

97

### 98 **Variables and Data Sources**

#### 99 *Outcome variables*

100 *Annual state-specific, age-adjusted firearm, non-firearm, and total homicide rates.*

101 The main outcome variable was the age-adjusted firearm homicide rate in each year  
102 analyzed. For example, Missouri’s “shall issue” law went into effect in 2003; thus, homicide  
103 rates associated with Missouri’s “shall issue” law were analyzed for the years 2004-2015.  
104 Homicide rates were obtained from the Centers for Disease Control and Prevention’s Web-  
105 Based Injury Statistics Query and Reporting Systems database.<sup>1</sup> This is the ideal source for

106 homicide data because there is complete annual reporting from all 50 states and because the  
107 data are extracted from the vital statistics death registry maintained by the National Center  
108 for Health Statistics (NCHS), which is based on standardized death certificates. The  
109 completeness of reporting is approximately 99%.<sup>18</sup> Rates were age-adjusted to the 2000  
110 standard population.

111 *Annual state-specific handgun and long gun homicide rates.* The second outcome  
112 variable was the handgun or long gun homicide rate, obtained from the Federal Bureau of  
113 Investigation's Uniform Crime Reports, Supplemental Homicide Reports (SHR).<sup>19</sup> While  
114 WISQARS does provide mortality data from ICD-9 and ICD-10 codes that can list handgun  
115 and long gun as the cause of death, unfortunately, most death certificates involving a firearm  
116 homicide do not specify the type of weapon used. Therefore, most firearm homicide deaths in  
117 WISQARS are classified as "other and unspecified" firearm, and it is not possible to use  
118 these data to disaggregate handgun and long gun homicides.<sup>20</sup> In contrast, the SHR is missing  
119 data on the type of weapon used in firearm homicides in just 13.4% of cases. Thus, the SHR  
120 is the best, if not only source for state-specific, firearm type-specific homicide data.

121 The SHR disaggregates firearm homicides into handgun, rifle, shotgun, and other  
122 (and unknown). We used the handgun deaths to generate handgun homicide rates and the  
123 sum of rifle, shotgun, and other gun deaths to generate long gun homicide rates for each state  
124 and year. While SHR data may include listing of multiple weapons in an incident, only one  
125 weapon may be associated with a homicide death.<sup>21</sup> Because of missing data on weapon type,  
126 we excluded 13.4% of firearm homicide cases in estimating handgun homicide rates.  
127 Nevertheless, there was little discrepancy between the firearm homicide totals from  
128 WISQARS and the SHR, which were correlated at  $r=0.98$ .



129 Because not all local law enforcement agencies complete the supplemental reports,  
130 the SHR data set excludes approximately 10% of all homicides.<sup>22</sup> This problem was  
131 addressed by applying weights that adjust each state-and year-specific estimate up to the  
132 overall number of homicides reported in the Uniform Crime Report for that state and year.  
133 Fox kindly provided us with updated SHR files that added previously missing data for  
134 Florida and included data through 2015.<sup>22</sup>

135

136 ***Main predictor variable***

137 Using *Thomson Reuters Westlaw* to access historical state statutes and session laws,  
138 we developed a database indicating the presence or absence of 100 provisions of firearm laws  
139 in each state over the 26-year period.<sup>5</sup> We coded laws by the year they went into effect,  
140 regardless of the month of the effective date. However, in the analytic models, we lagged the  
141 state laws by one year, which ensured that all laws were in effect during the year in which  
142 their impact was being assessed. Following Lott and Mustard,<sup>23</sup> the impact of laws was  
143 assessed starting in the first full year they were in effect.

144 In this study, we examined the potential impact of “shall issue” laws, comparing them  
145 to “may issue” laws. In other words, using the “may issue” states as the reference group, we  
146 estimated the impact of “shall issue” laws on homicide rates. Since only four states had  
147 “permitless carry” laws in place during the study period, there were not enough observations  
148 to allow any meaningful analyses of these laws. Therefore, we deleted state-year  
149 observations where a “permitless carry” law was in effect.

150

151 ***Control variables***

152 We controlled for 12 state-level factors that: (1) were found in the prior literature<sup>6-15</sup>  
153 to be significantly related to homicide rates; and (2) were significantly related to the presence  
154 of “shall issue” laws in our dataset (i.e., the regression coefficient for the variable was  
155 significant at a level of  $p=0.05$  in a logistic regression with “shall issue” law as the dependent  
156 variable): household firearm ownership (using the standard proxy which is the percentage of  
157 all suicides committed with a firearm), proportion of Blacks, proportion of young adults  
158 (ages 18-29), proportion of males among young adults (ages 18-29), proportion of the  
159 population living in urban areas, total population, population density, per capita alcohol  
160 consumption, the non-homicide violent crime rate (aggravated assault, robbery, and forcible  
161 rape), the poverty rate, unemployment rate, median household income, per capita disposable  
162 income, incarceration rate, and per capita number of law enforcement officers. Variable  
163 definitions and data sources are provided in Supplemental Table 2. We also controlled for the  
164 following state firearm laws that could serve as alternative explanations for changes in  
165 homicide during the study period: (1) universal background checks required for all handgun  
166 purchases; (2) waiting periods required for all handgun purchases; and (3) permits required to  
167 purchase or possess firearms.

168

## 169 **Analysis**

### 170 *Count models*

171 Since homicide rates are not normally distributed but skewed and overdispersed, we  
172 modeled this outcome using a negative binomial distribution. To control for clustering in our  
173 data by year (25 levels) and by state (50 levels), we entered year and state as fixed effects in  
174 the regression models. We used robust standard errors that account for the clustering of  
175 observations, serial autocorrelation, and heteroskedasticity.<sup>24</sup>

176 Our final model was as follows:

177 
$$(1) Pr(H_{st} = h_{st}) = [ \Gamma(y_{st} + \alpha^{-1}) / \Gamma(y_{st} + 1) \Gamma \alpha^{-1} ] [ 1 / (1 + \alpha \mu_{st}) ]^{1/\alpha} [ \mu_{st} / (\alpha^{-1} + \mu_{st}) ]^{y_{st}},$$

178 where:  $Pr(H_{st} = h_{st})$  is the probability that state  $s$  in year  $t$  has a homicide rate equal to  $h_{st}$ ,

179  $E(H_{st}) = \mu_{st}$ , and  $Var(H_{st}) = \mu_{st} + \alpha \mu_{st}^2$ .

180 The mean homicide rate was then modeled as follows:

181 
$$(2) \ln(\mu_{st}) = \alpha + \beta_1 CC_{st} + \beta_2 C_{st} + S + T + e,$$

182 where  $CC_{st}$  is a dummy variable for the presence of a “shall issue” law,  $C$  is a vector of

183 control variables,  $S$  represents state fixed effects, and  $T$  represents year fixed effects.

184 The negative binomial regression coefficients are reported as incidence rate ratios  
185 (IRR). The IRR indicates the percentage difference in homicide rate for states with a “shall  
186 issue” concealed carry law compared to states with a “may issue” law.

187

### 188 *Linear models*

189 To check the robustness of our findings, we repeated the analyses using a linear  
190 regression model, with the log-transformed homicide rate as the outcome variable, again  
191 using robust standard errors.<sup>24</sup> As with the negative binomial models, we included year and  
192 state fixed effects, and we included the same state-level control variables.

193

### 194 *Analytic software and significance testing*

195 We conducted analyses using STATA version 14.1 (College Station, TX: StataCorp).  
196 The significance of regression coefficients was evaluated using a Wald test at  $\alpha=0.05$ .

197

### 198 *Sensitivity analyses*

199 We checked the robustness of our results by conducting several sensitivity analyses,  
200 including: (1) restricting the analysis to the 23 states in which “shall issue” laws were  
201 adopted during the study period; (2) using raw count data instead of homicide rates; (3)  
202 restricting the analysis to states with population greater than 1,000,000; (4) restricting the  
203 analysis to the period 1991-2002; (5) restricting the analysis to the period 2003-2015; and (6)  
204 using SHR instead of WISQARS homicide data (thus avoiding the problem of missing data  
205 for some smaller states after 1998).

206

## 207 **RESULTS**

208 During the study period, 23 states adopted “shall issue” laws (Table 1). By 2015, 37  
209 states had such laws. In the same year, the average firearm homicide rate in the states with  
210 “shall issue” laws was 4.11 per 100,000, compared to 3.41 per 100,000 in the “may issue”  
211 states. The number of states that had “permitless carry” laws in effect at all during the study  
212 period was small (N=4), as was the number of observations (N=46), limiting our ability to  
213 analyze the impact of these laws. Because CDC does not report homicide counts below 10 in  
214 years after 1998, we were missing outcome data for several years for six states (Hawaii, New  
215 Hampshire, North Dakota, South Dakota, Vermont, and Wyoming); a sensitivity analysis  
216 using SHR data source revealed that these omissions do not affect our findings.

217 In negative binomial regression models, “shall issue” concealed carry permitting laws  
218 were significantly associated with 6.5% higher total homicide rates compared to “may issue”  
219 states (IRR = 1.065; 95% confidence interval [CI], 1.032-1.099) (Table 3). The association  
220 was specific to firearm homicide rates, which were 8.6% higher in “shall issue” states (IRR =  
221 1.086; 95% CI, 1.047-1.126). There was no significant association between “shall issue”  
222 laws and non-firearm homicide rates. Further disaggregation within firearm homicides

223 showed that the association between “shall issue” laws and firearm homicide rates was  
224 specific to handgun homicide. “Shall issue” states had handgun homicide rates that were  
225 10.6% higher (IRR = 1.106; 95% CI, 1.039-1.177), but there was no significant association  
226 with long gun homicide rates.

227 The results of the linear regression analyses were similar. Here, “shall issue” laws  
228 were significantly associated with 6.6% higher total homicide rates compared to “may issue”  
229 states (95% CI, 3.0% to 10.4%), (data not shown). The association was specific to firearm  
230 homicide rates, which were 11.7% higher in “shall issue” states (95% CI, 6.4% to 17.2%);  
231 there was no significant association between these laws and non-firearm homicide rates.  
232 Further disaggregation within firearm homicides showed that the association between “shall  
233 issue” laws and firearm homicide rates was specific to handgun homicide. “Shall issue”  
234 states had handgun homicide rates that were 19.8% higher (95% CI, 10.3% to 30.1%), but  
235 rates of long gun homicide were not significantly different in states with “shall issue”  
236 compared to “may issue” laws.

237 The significant association between “shall issue” laws and higher total, firearm, and  
238 handgun-related homicide rates remained when we restricted the analysis to the 23 states in  
239 which these laws were adopted during the study period (Table 4). This pattern of results was  
240 robust to a series of additional sensitivity checks, including using raw count data, restricting  
241 the analysis to states with a population of more than 1,000,000, restricting the analysis to the  
242 period 1991-2002, restricting the analysis to the period 2003-2015, and using SHR instead of  
243 WISQARS homicide data.

244

245 **DISCUSSION**

246 To the best of our knowledge, this is the first study to examine the relationship  
247 between concealed carry permitting laws and handgun-specific homicide rates. We found  
248 that, using both count and linear models and after controlling for a range of time-varying  
249 state factors and for unobserved time-invariant state factors using a fixed effects model,  
250 “shall issue” concealed carry permitting laws were significantly associated with 6.5% higher  
251 total homicide rates, 8.6% higher firearm-related homicide rates, and 10.6% higher handgun-  
252 specific homicide rates compared to “may issue” states.

253 A major reason for inconsistent results in the existing literature on the effects of  
254 concealed carry laws may be that the relationship between concealed carry laws and  
255 homicide rates was different during the period before and after the early 1990s.<sup>12,16</sup> It is  
256 possible that despite the enactment of early “shall issue” laws in the 1970s and 1980s, the  
257 demand for handgun permits in those states was modest. There has been a striking increase in  
258 the demand for pistols, especially those designed for concealed carry, during the past  
259 decade.<sup>25</sup> Recently, Steidley found that the adoption of “shall issue” laws during the period  
260 1999-2013 was associated with a persistent, long-term increase in handgun sales in all seven  
261 states studied.<sup>26</sup> Our analysis provides further support for the hypothesis that the relationship  
262 between “shall issue” laws and higher homicide rates increased over time, as the regression  
263 coefficients for these laws was higher for the second half of the study period (2003-2015)  
264 compared to the first half (1991-2002).

265 Our finding that the association between “shall issue” laws and homicide rates is  
266 specific to handgun homicides adds plausibility to the observed relationship. If the  
267 relationship between “shall issue” laws and homicide rates were spurious, one might expect  
268 to see the relationship hold for long gun as well as handgun homicide rates. Moreover, this

269 finding is inconsistent with the hypothesis that permissive concealed carry laws deter crime  
270 by increasing the presence of armed individuals. Were that the case, one would expect to see  
271 lower handgun, non-handgun, and non-firearm homicide rates in “shall issue” compared to  
272 “may issue” states. The lack of an association between “shall issue” laws and long gun  
273 homicide rates is also inconsistent with the hypothesis that the presence of more concealed  
274 weapons escalates the level of violence in encounters that may involve a long gun.

275           This study has several novel strengths, including the use of both count and linear  
276 models, the use of recent data (through 2015), and the disaggregation of homicide rates.  
277 Nevertheless, caution should be exercised in assessing causality from an ecological study  
278 such as this one. In particular, these results should be interpreted with caution because of the  
279 possibility that they reflect a reverse association. That is, it is possible that the adoption of  
280 “shall issue” concealed carry laws is associated with higher baseline homicide rates so that  
281 we are picking up not a causal effect of these laws on homicide but a systematic difference in  
282 baseline homicide rates between states that do or do not have these laws. However, our  
283 findings hold even when the analysis is restricted to states that started with “may issue” laws  
284 at the beginning of the study period and adopted “shall issue” laws during the study period.

285           An additional limitation of this study is that we could not consider the enforcement of  
286 concealed carry laws.<sup>27</sup> Enforcement of these laws may vary not only among states, but even  
287 among counties in the same state.<sup>12</sup> In addition, we did not have information on the number  
288 of concealed carry permits issued in each state or the number of homicides committed by  
289 concealed carry permittees.

290 It is also important to note that we examined only fatal firearm injuries. Further  
291 research should investigate potential effects of concealed carry laws on non-fatal firearm  
292 injuries.

293 Finally, we were unable to analyze the impact of “permitless carry” laws due to the  
294 small number of observations. Only four states had “permitless carry” laws in place during  
295 the study period. However, in the past two years, an additional five states have enacted such  
296 laws. Elucidating the impact of “permitless carry” laws will require follow-up of the nine  
297 states that now have such laws in effect.

298 Despite these limitations, this study suggests that there is a robust association  
299 between “shall issue” laws and higher rates of firearm homicides. The trend toward  
300 increasingly permissive concealed carry laws is inconsistent with public opinion, which tends  
301 to oppose the carrying of guns in public.<sup>35</sup> Our findings suggest that these laws may also be  
302 inconsistent with the promotion of public safety.



303 **About the Authors**

304 Michael Siegel, Ziming Xuan, Craig S. Ross, and Sandro Galea are with the Boston  
305 University School of Public Health. Bindu Kalesan is with the Boston University School of  
306 Medicine. Eric Fleegler is with Children’s Hospital Boston. Kristin A. Goss is with the  
307 Sanford School of Public Policy, Duke University, Durham, NC.

308 Correspondence should be sent to Michael Siegel, MD, MPH, Department of  
309 Community Health Sciences, Boston University School of Public Health, 801 Massachusetts  
310 Avenue, Boston, MA 02118 (e-mail: mbsiegel@bu.edu).

311 This article was accepted August 1, 2017.

312

313 **Contributors**

314 M. Siegel conceptualized the study, led the data analysis and writing, and was the principal  
315 author of this article. Z. Xuan and C. S. Ross assisted with the study design and analytical  
316 plan. All authors contributed toward the interpretation of data analyses, critical review of the  
317 manuscript, and revision of the manuscript.

318

319 **Acknowledgments**

320 Support for this research was provided by the Robert Wood Johnson Foundation Evidence  
321 for Action Program (grant #73337). The views expressed here do not necessarily reflect those  
322 of the Foundation.

323 We gratefully acknowledge the assistance of James Alan Fox, PhD, the Lipman  
324 Family Professor of Criminology, Law and Public Policy at the School of Criminology and

325 Criminal Justice at Northeastern University, who kindly provided the Multiply-Imputed  
326 Supplemental Homicide Reports File, 1976-2015, including the data sets and a codebook.

327

328 **Human Participant Protection**

329 This study made use of secondary data only and did not require institutional review board

330 approval.

331 **References**

- 332 1. Centers for Disease Control and Prevention (CDC). Web-based injury statistics query and  
333 reporting systems: Fatal injury reports. Available at:  
334 [http://www.cdc.gov/injury/wisqars/fatal\\_injury\\_reports.html](http://www.cdc.gov/injury/wisqars/fatal_injury_reports.html). Accessed March 15, 2017.
- 335 2. Donohue JJ. Guns, crime, and the impact of state right-to-carry laws. *Fordham Law Rev.*  
336 2005;73:623-652.
- 337 3. Lott JR. *More Guns, Less Crime: Understanding Crime and Gun Control Laws* (3<sup>rd</sup> ed.).  
338 Chicago: The University of Chicago Press; 2010.
- 339 4. Miller M, Azrael D, Hemenway D. Firearms and violent death in the United States. In:  
340 Webster DW, Vernick JS, eds. *Reducing Gun Violence in America: Informing Policy*  
341 *with Evidence and Analysis*. Baltimore, MD: The Johns Hopkins University Press; 2013.
- 342 5. Siegel M, Pahn M, Xuan Z, Ross CS, Galea S, Kalesan B, Fleegler E, Goss KA. Firearm-  
343 related laws in all 50 states, 1991-2016. *Am J Public Health*. Published online ahead of  
344 print May 18, 2017. doi: 10.2105/AJPH.2017.303701.
- 345 6. Lott, JR. *More Guns, Less Crime: Understanding Crime and Gun-Control Laws*.  
346 Chicago, IL: The University of Chicago Press; 2010.
- 347 7. Lott JR, Jr., Whitley JE. Safe-storage gun laws: Accidental deaths, suicides, and crime. *J*  
348 *Law Econ.* 2001;44:659-689.
- 349 8. Zimmerman PR. The deterrence of crime through private security efforts: Theory and  
350 evidence. *Int Rev Law Econ.* 2014;37:66-75.
- 351 9. Ludwig J. Concealed-gun-carrying laws and violent crime: Evidence from state panel  
352 data. *Int Rev Law Econ.* 1998;18:239-254.

- 353 10. Aneja A, Donohue JJ, Zhang A. The impact of right-to-carry laws and the NRC report:  
354 Lessons for the empirical evaluation of law and policy. *American Law and Economics*  
355 *Review*. 2011;13(2):565-632.
- 356 11. Rosengart M, Cummings P, Nathens A, Heagerty P, Maier R, Rivara F. An evaluation of  
357 state firearm regulations and homicide and suicide death rates. *Inj Prev*. 2005;11:77-83.
- 358 12. Hepburn L, Miller M, Azrael D, Hemenway D. The effect of nondiscretionary concealed  
359 weapon carrying laws on homicide. *J Trauma*. 2004;56:676-681.
- 360 13. Sommers PM. Deterrence and gun control: An empirical analysis. *Atl Econ J*. 1980;8:89-  
361 94.
- 362 14. DeZee MR. Gun control legislation: Impact and ideology. *Law Policy Q*. 1983;5(3):367-  
363 379.
- 364 15. Murray DR. Handguns, gun control laws and firearm violence. *Soc Probl*. 1975;23:81-93.
- 365 16. Ayres I, Donohue JJ, III. Shooting down the ‘more guns, less crime’ hypothesis. *Stanford*  
366 *Law Rev*. 2003;55:1193-1300.
- 367 17. Plassmann F, Tideman TN. Does the right to carry concealed handguns deter countable  
368 crimes? Only a count analysis can say. *J Law Econ*. 2001;44:771-798.
- 369 18. Regoeczi W, Banks D. *The Nation’s Two Measures of Homicide*. Washington, DC: U.S.  
370 Department of Justice, Office of Justice Programs, Bureau of Justice Studies; 2014.
- 371 19. National Archive of Criminal Justice Data. *Uniform Crime Reporting Program Data*  
372 *Series. Supplemental Homicide Reports, 1981-2015*. Ann Arbor, MI: Inter-university  
373 Consortium for Political and Social Research; 2016.
- 374 20. Rokaw WM, Mercy JA, Smith JC. Comparing death certificate data with FBI crime  
375 reporting statistics on US homicides. *Public Health Reports*. 1990;105:447-455.

- 376 21. Federal Bureau of Investigation. Supplementary Homicide Report (OMB Form No. 1110-  
377 0002), Offense 1a. Murder and nonnegligent manslaughter. Washington, DC: Federal  
378 Bureau of Investigation; 2017. Available at: [https://ucr.fbi.gov/nibrs/addendum-for-](https://ucr.fbi.gov/nibrs/addendum-for-submitting-cargo-theft-data/shr)  
379 [submitting-cargo-theft-data/shr](https://ucr.fbi.gov/nibrs/addendum-for-submitting-cargo-theft-data/shr). Accessed June 17, 2017.
- 380 22. Fox J. *Multiply-imputed Supplementary Homicide Reports File, 1976-2015*. Boston, MA:  
381 Northeastern University; 2017.
- 382 23. Lott JR, Mustard DB. Crime, deterrence, and right-to-carry concealed handguns. *J Legal*  
383 *Stud.* 1997;26:1-68.
- 384 24. White H. A heteroskedasticity-consistent covariance matrix estimator and a direct test for  
385 heteroskedasticity. *Econometrica.* 1980;48(4):817–838.
- 386 25. Smith VM, Siegel M, Xuan Z, et al. Broadening the perspective on gun violence: An  
387 examination of the firearms industry, 1990-2015. *Am J Prev Med* (published online ahead  
388 of print on June 22, 2017). <https://doi.org/10.1016/j.amepre.2017.05.002>.
- 389 26. Steidley T. *Movements, Malefactions, and Munitions: Determinants and Effects of*  
390 *Concealed Carry Laws in the United States*. Dissertation. Columbus, OH: The Ohio State  
391 University; 2016.
- 392 27. Lott JR. *Not All Right-to-Carry Laws are the Same, Yet Much of the Literature Keeps*  
393 *Ignoring the Differences*. Swarthmore, PA: Crime Prevention Research Center;  
394 September 5, 2014. Available at SSRN: <https://ssrn.com/abstract=2524729>. Accessed  
395 April 15, 2017.
- 396 28. U.S. Census Bureau. Population and housing unit estimates. Available at:  
397 <https://www.census.gov/programs-surveys/popest/geographies.html>. Accessed March 14,  
398 2017.

- 399 29. LaVallee RA, Yi H. *Apparent Per Capita Alcohol Consumption: National, State, and*  
400 *Regional Trends, 1977-2010*. Arlington, VA: CSR, Incorporated and National Institute on  
401 Alcohol Abuse and Alcoholism; 2012.
- 402 30. Federal Bureau of Investigation. Uniform Crime Reporting Statistics. Washington, DC:  
403 U.S. Department of Justice; 2016. Available at <https://www.ucrdatatool.gov>. Accessed  
404 March 10, 2017.
- 405 31. U.S. Census Bureau. Income and poverty. Available at:  
406 <https://www.census.gov/topics/income-poverty.html>. Accessed March 14, 2017.
- 407 32. U.S. Bureau of Labor Statistics. Local area unemployment statistics. Available at:  
408 <https://www.bls.gov/web/laus/laumstrk.htm>. Accessed March 14, 2017.
- 409 33. Bureau of Justice Statistics. National Prisoner Statistics. Prisoner Series Reports, 1991---  
410 2015. Washington, DC: US Department of Justice. Available at:  
411 <http://bjs.gov/index.cfm?ty=pbse&sid=40>. Accessed April 2, 2017.
- 412 34. Federal Bureau of Investigation. Uniform Crime Reporting Statistics. Police employment  
413 data. Washington, DC: U.S. Department of Justice; 2016. Available at  
414 <https://ucr.fbi.gov/crime-in-the-u.s/2014/crime-in-the-u.s.-2014/police-employee->  
415 [data/main](https://ucr.fbi.gov/crime-in-the-u.s/2014/crime-in-the-u.s.-2014/police-employee-data/main). Accessed March 10, 2017.
- 416 35. Wolfson JA, Teret SP, Azrael D, Miller M. US public opinion on carrying firearms in  
417 public places. *Am J Public Health*. 2017;107(6):929-937.

**TABLE 1—Concealed Carry Permitting Laws and Age-adjusted Firearm Homicide Rates by State, 2015 and Status of Laws During the Period 1991-2015**

State	Age-adjusted Firearm Homicide Rate <sup>a</sup> , 2015 (per 100,000)	Status of Concealed Carry Permitting Law, 2015	Effective Date of Current (as of 2015) Concealed Carry Law
Hawaii <sup>b</sup>	0.75	May issue	Prior to 1991
New Hampshire	0.96	Shall issue	Prior to 1991
Rhode Island	0.99	May issue	Prior to 1991
Maine	1.14	Shall issue	Prior to 1991
Massachusetts	1.26	May issue	Prior to 1991
Utah	1.39	Shall issue	1995
Idaho	1.29	Shall issue	Prior to 1991
Iowa	1.62	Shall issue	Prior to 1991
North Dakota	1.69	Shall issue	Prior to 1991
Vermont	1.76	Permitless carry	Prior to 1991
Minnesota	1.77	Shall issue	2003
South Dakota	1.97	Shall issue	Prior to 1991
New York	2.07	May issue	Prior to 1991
Wyoming	2.16	Permitless carry	2011 <sup>c</sup>
Montana	2.17	Shall issue	Prior to 1991
Washington	2.32	Shall issue	Prior to 1991
Oregon	2.35	Shall issue	Prior to 1991
Connecticut	2.43	May issue	Prior to 1991
Colorado	2.46	Shall issue	2003

Nebraska	2.67	Shall issue	2007
West Virginia	2.89	Shall issue	Prior to 1991
Wisconsin	3.18	Shall issue	2011
New Jersey	3.22	May issue	Prior to 1991
Virginia	3.29	Shall issue	1995
Kansas	3.35	Shall issue	2007
California	3.52	May issue	Prior to 1991
Arizona	3.56	Permitless carry	2010 <sup>c</sup>
Kentucky	3.96	Shall issue	1996
Texas	4.04	Shall issue	1995
Pennsylvania	4.34	Shall issue	Prior to 1991
Ohio	4.38	Shall issue	2004
Nevada	4.49	Shall issue	1995
North Carolina	4.54	Shall issue	1995
Indiana	4.61	Shall issue	Prior to 1991
Florida	4.66	Shall issue	Prior to 1991
Michigan	4.74	Shall issue	2001
New Mexico	4.79	Shall issue	2001
Alaska	5.22	Permitless carry	2003 <sup>c</sup>
Arkansas	5.34	Shall issue	1995
Illinois	5.45	Shall issue	2013
Tennessee	5.51	Shall issue	1994
Georgia	5.73	Shall issue	Prior to 1991



Oklahoma	5.87	Shall issue	1995
Delaware	6.12	May issue	Prior to 1991
South Carolina	7.55	Shall issue	1996
Maryland	7.69	May issue	Prior to 1991
Missouri	7.92	Shall issue	2003
Alabama	8.43	Shall issue	2013
Mississippi	9.11	Shall issue	1991
Louisiana	9.96	Shall issue	1996

---

<sup>a</sup>From Centers for Disease Control and Prevention (CDC). *Web-based Injury Statistics Query and Reporting Systems: Fatal Injury Reports*. Available at: [http://www.cdc.gov/injury/wisqars/fatal\\_injury\\_reports.html](http://www.cdc.gov/injury/wisqars/fatal_injury_reports.html).

<sup>b</sup>Data for Hawaii are unavailable for the years 2010 to 2015 because CDC WISQARS does not report homicide counts less than 10. The data here are from 2009.

<sup>c</sup>Changed from “may issue” to “shall issue” in 1994.

**Table 2—Elements of Discretion in Law Enforcement Decisions to Approve or Deny Concealed Handgun Carry Permits—**

**“May Issue” States, 2015**

State	Elements of Discretion	Citation
California	Applicant must be of "good moral character" and must have "good cause" for issuance of the license	California Penal Code § 26150, § 26155
Connecticut	Applicant must intend only to make "legal use" of the handgun and must be a "suitable person to receive such permit."	Connecticut General Statutes § 29-28
Delaware	Applicant must be "of good moral character," must desire the handgun for "personal protection" or "protection of the person's property," and must submit signed, written statements of five "respectable citizens" of the county who testify that the applicant is a person "of sobriety and good moral character" and "bears a good reputation for peace and good order in the community" and that a handgun is "necessary for the protection of the applicant or the applicant's property." The Superior Court has discretion to approve or deny the application.	Delaware Code § 1441
Hawaii	Must be "an exceptional case," the applicant must show "reason to fear injury to the applicant's person or property," the applicant must be "a suitable person" to be licensed, and the chief of police must determine that the person "is qualified to use the firearm in a safe manner."	Hawaii Revised Statutes § 134-9
Maryland	Applicant must have a "good and substantial reason to wear, carry, or transport a handgun, such as a finding that the permit is necessary as a reasonable precaution against apprehended danger," and the applicant must not have "exhibited a propensity for violence or instability that may reasonably render the person's possession of a handgun a danger to the person or to another."	Maryland Public Safety Code § 5-306
Massachusetts	Applicant must be a "suitable" person and must not be judged to potentially create a risk to public safety.	Massachusetts General Laws 140 § 131

New Jersey	Applicant must demonstrate a "justifiable need to carry a handgun" and must submit endorsements by three individuals who have known the applicant for at least three years that the applicant is "a person of good moral character and behavior."	New Jersey Statutes § 2C:58-4
New York	Applicant must be "of good moral character," must be "of good character, competency, and integrity," and there must be no "good cause" for denial of the license.	New York Penal Law § 400.00
Rhode Island	Applicant must have "good reason to fear an injury to his or her person or property" or have "any other proper reason" for carrying a handgun and must be a "suitable person to be so licensed."	General Laws of Rhode Island § 11-47-11

---

**TABLE 3—Incidence Rate Ratios (95% Confidence Intervals) of Shall Issue vs. May Issue Laws and Total, Firearm, Non-firearm, Handgun, and Long Gun Homicide Rates in 50 US States, 1991-2015<sup>a</sup>**

Variable	Homicide rate				
	Total	Firearm	Non-firearm	Handgun	Long gun
“Shall issue” laws	1.065* (1.032-1.099)	1.086* (1.047-1.126)	1.014 (0.963-1.068)	1.106* (1.039-1.177)	0.999 (0.915-1.090)

\*p<0.05

<sup>a</sup>In these final negative binomial models, the reference group is states with “may issue” laws. All models include year and state fixed effects and control for the following time-varying, state-level factors: household gun ownership levels, proportion of young males, proportion of young adults, proportion of blacks, proportion living in an urban area, total population, population density, median household income, poverty rate, unemployment rate, per capita disposable income, per capital alcohol consumption, violent crime rate, incarceration rate, per capita law enforcement officers, universal background check laws for all handguns, waiting periods for all handguns, and permits required for all firearms.

**Table 4—Relationship Between “Shall Issue” Concealed Carry Permitting Laws and Homicide Rates (Incidence Rate Ratio and 95% Confidence Interval): Sensitivity Analyses<sup>a</sup>**

	Homicide Rate		
	Total	Firearm	Handgun
Analysis restricted to states that adopted “shall issue” concealed carry laws during study period	1.063* (1.028-1.099)	1.068* (1.030-1.108)	1.074* (1.002-1.150)
Analysis using raw count of homicides with population as the exposure variable	1.051* (1.020-1.083)	1.079* (1.039-1.120)	1.139* (1.067-1.217)
Analysis restricted to states with population > 1 million	1.055* (1.023-1.087)	1.067* (1.030-1.105)	1.095* (1.029-1.166)
Analysis restricted to years prior to 2003 (1991-2002)	1.058* (1.014-1.104)	1.067* (1.019-1.116)	1.107* (1.037-1.180)
Analysis restricted to years after 2002 (2003-2015)	1.064* (1.009-1.122)	1.100* (1.028-1.176)	1.274* (1.092-1.488)
Analysis using Supplemental Homicide Report data instead of Vital Statistics data	1.044* (1.006-1.083)	1.094* (1.047-1.143)	1.106* (1.039-1.177)

\*p<0.05

<sup>a</sup>All models include year and state fixed effects and control for the following time-varying, state-level factors: household gun ownership levels, proportion of young males, proportion of young adults, proportion of blacks, proportion living in an urban area, total population, population density, median household income, poverty rate, unemployment rate, per capita disposable income, per capita alcohol consumption, violent crime rate, incarceration rate, per capita law enforcement officers, universal background check laws for all handguns, waiting periods for all handguns, and permits required for all firearms.

**SUPPLEMENTAL TABLE 1—Previous National Studies of the Effect of State-level, Concealed Carry Permit Legislation on Total or Firearm-Related Homicide Rates at the State Level**

<b>Study and Years Covered</b>	<b>Law Studied</b>	<b>Outcome</b>
Zimmerman, 2014 (1999-2010)	Permissive concealed carry laws (“shall issue”)	Significant increase in homicide rates
Aneja et al., 2011 (1977-2006)	Permissive concealed carry laws (“shall issue”)	No significant association with homicide rates
Lott, 2010 (1977-2005)	Permissive concealed carry laws (“shall issue”)	Permissive concealed carry laws associated with significant decrease in homicide rates
Rosengart et al., 2005 (1979-1998)	Permissive concealed carry laws (“shall issue”)	Shall issue laws associated with a non-significant increase in firearm and total homicide rates
Hepburn et al., 2004 (1979-1998)	Permissive concealed carry laws (“shall issue”)	No association between concealed carry laws and homicide rates
Lott and Whitley, 2001 (1979-1996)	Permissive concealed carry laws (“shall issue”)	Permissive concealed carry laws associated with significant reduction in homicide rates
Ludwig, 1998 (1977-1994)	Permissive concealed carry laws (“shall issue”)	Permissive concealed carry laws associated with significantly higher adult homicide rates
Sommers, 1980 (1977)	Permissive concealed carry laws (“shall issue”)	No effect on homicide rates
DeZee, 1983 (1978)	Permissive concealed carry laws (“shall issue”)	No significant effect on overall homicide rates
Murray, 1975 (1970)	Permissive concealed carry laws (“shall issue”)	No significant effect on overall homicide rates

**SUPPLEMENTAL TABLE 2—Variables and Data Sources**

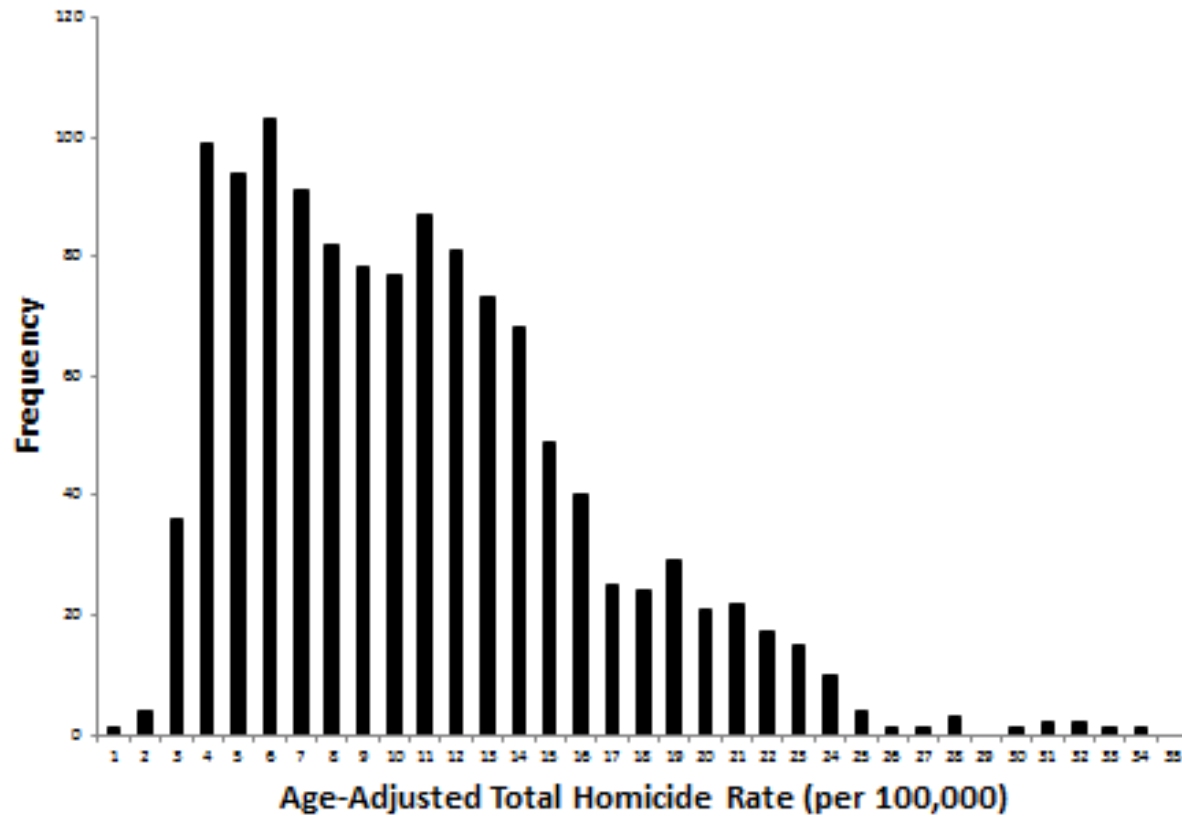
<b>Variable</b>	<b>Definition</b>	<b>Mean (standard deviation)</b>	<b>Source</b>
Household firearm ownership (proxy)	Percentage of households with a firearm, using a proxy which is the proportion of all suicides committed using a firearm	55.2% (13.0%)	Centers for Disease Control and Prevention. Web-based Injury Statistics Query and Reporting Systems (WISQARS): Fatal Injury Reports <sup>1</sup>
Race/ethnicity - black	Percentage of population that is black	10.7% (9.5%)	Centers for Disease Control and Prevention. Web-based Injury Statistics Query and Reporting Systems (WISQARS): Fatal Injury Reports <sup>1</sup>
Age – young adults	Proportion of population ages 18-29	21.0% (0.04%)	U.S. Bureau of the Census <sup>28</sup>
Age/sex – young males	Proportion of young adults (ages 18-29) who are male	51.0% (0.02%)	U.S. Bureau of the Census <sup>28</sup>
Percent urban	Proportion of population living in urbanized area or urban cluster	72.4% (0.41%)	U.S. Bureau of the Census <sup>28</sup>
Population density	Population divided by land area in square miles	185.2 (250.1)	U.S. Bureau of the Census <sup>28</sup>
Population	Total population	5,771,576 (6,361,161)	U.S. Bureau of the Census <sup>28</sup>
Alcohol consumption	Per capita alcohol consumption among persons ages 14 and older	2.33 (0.49)	National Institute of Alcoholism and Alcohol Abuse <sup>29</sup>
Violent crime rate	Combined rate of aggravated assault, robbery, and forcible rape per 100,000 population	4.31 (2.13)	Federal Bureau of Investigation. Uniform Crime Reporting Statistics <sup>30</sup>
Poverty rate	Percentage of population living in poverty	13.0% (0.1%)	U.S. Bureau of the Census <sup>31</sup>
Disposable income	Per capita personal disposable income	\$34,944 (\$161)	U.S. Bureau of the Census <sup>31</sup>
Household income	Median household income (in 2010 dollars)	\$50,274 (\$227)	U.S. Bureau of the Census <sup>31</sup>
Unemployment rate	Percentage unemployed among civilian labor force, aged ≥16	5.7% (0.1%)	U.S. Bureau of Labor Statistics <sup>32</sup>
Incarceration rate	Prisoners with sentence >1 year per 100,000 population	369.3 (4.1)	Bureau of Justice Statistics <sup>33</sup>
Law	Per capita number of sworn law	2.09	Federal Bureau of Investigation <sup>34</sup>

---

enforcement capacity	enforcement officers	(0.01)
-------------------------	----------------------	--------

---





SUPPLEMENTAL FIGURE 1—Histogram showing distribution of state age-adjusted, total homicide rates, 1991-2015