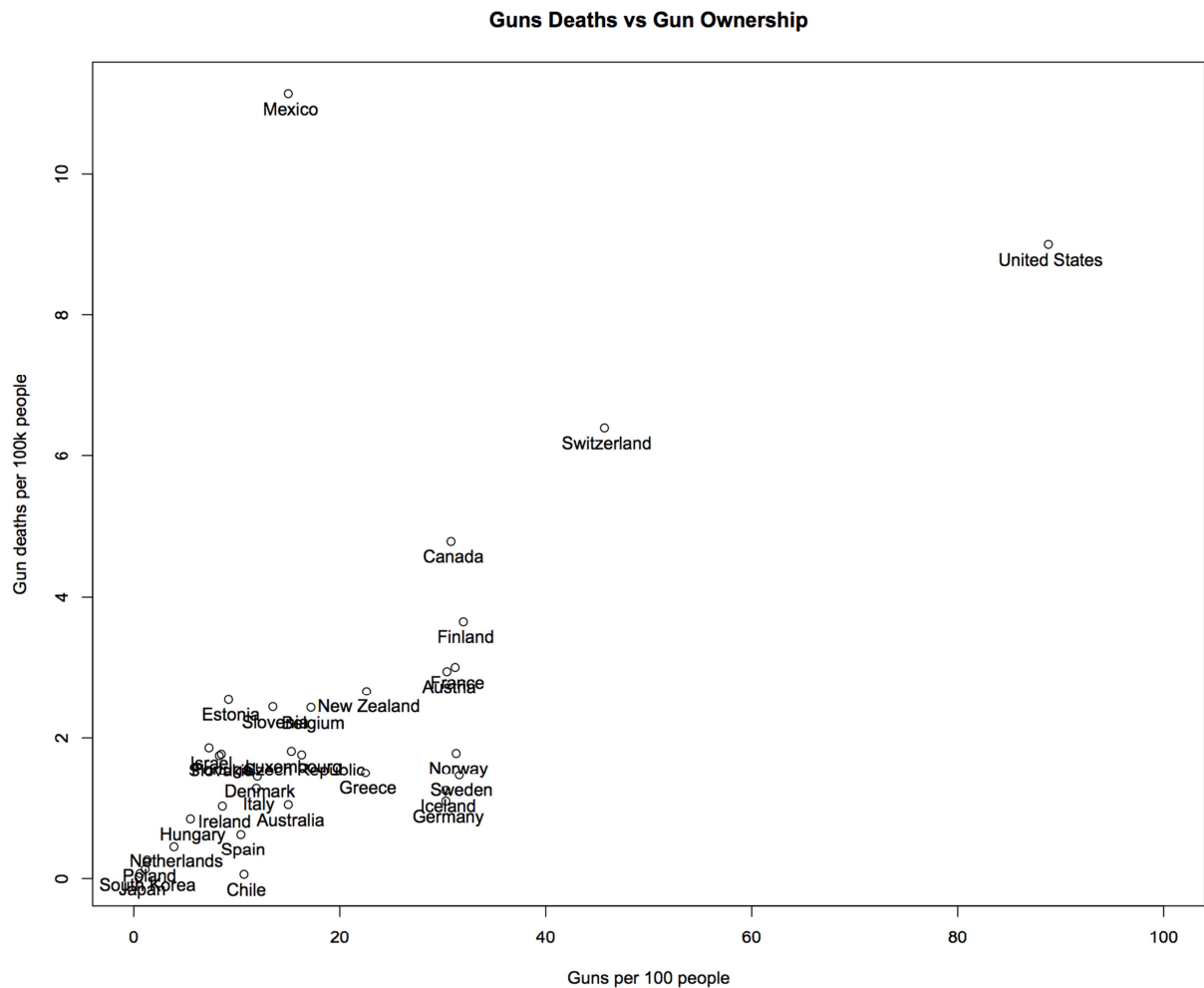


The Impact of Gun Ownership on Levels of Violence

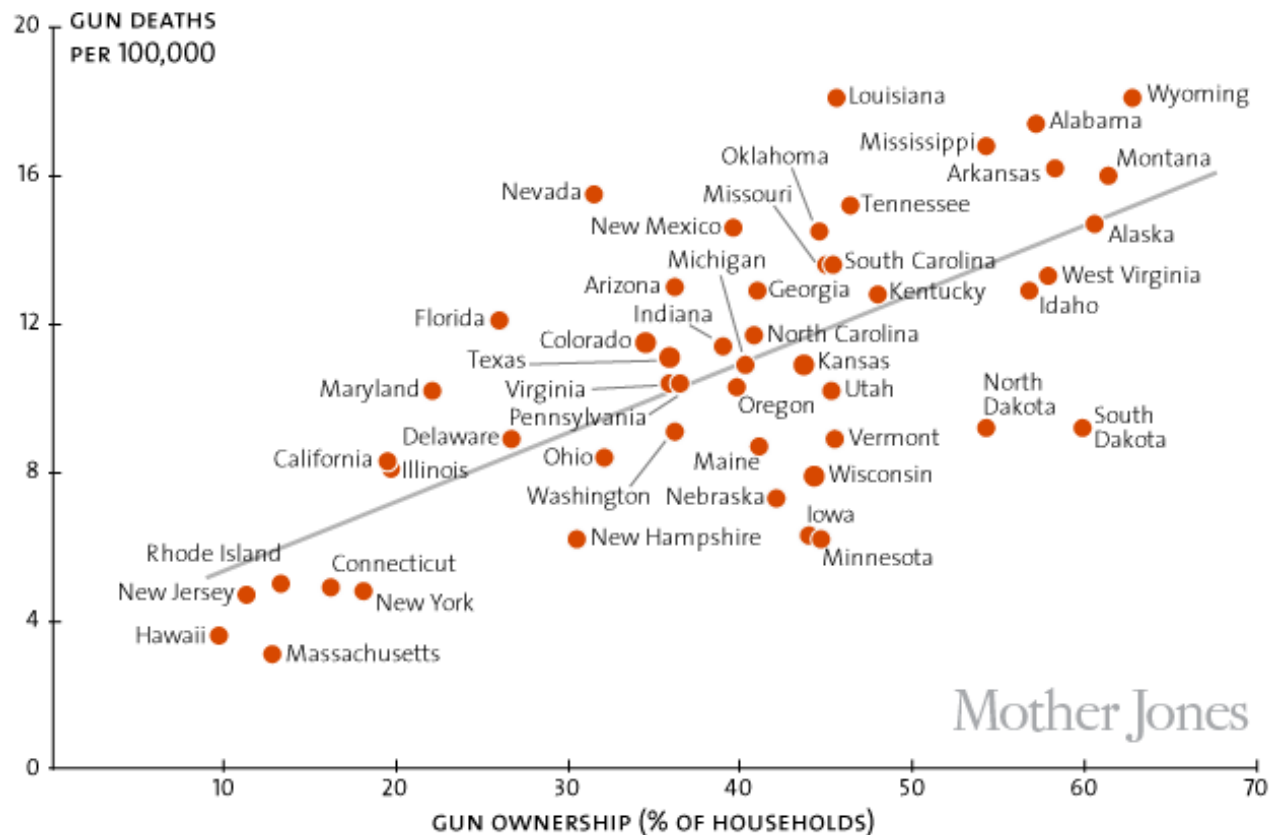
I first saw the following graph just one day after the Newtown Massacre:



This graph encouraged me to start the Sandy Hook Project, and one of my first goals was to determine if a similar relationship between levels of firearm ownership and violence can be demonstrated at the state level. If such a relationship does exist, this could indicate that the presence of firearms does increase the level of violence.

Recently I came across an article on Mother Jones with the following graph:

Gun ownership vs. gun deaths, by state



What immediately jumped out at me was the claim that Mother Jones had obtained firearm-ownership data at the state level. In my efforts to produce a similar graph I discovered that high quality statistics on firearm ownership do not exist. There is no definitive source for U.S. firearm ownership data. The ATF does not publish this data, nor are they able to accurately collect it. Quite the contrary, NRA lobbyists have succeeded in preventing such data collection from occurring in the passage of the [Tiahrt Amendment](#).

Therefore, the primary methods for estimating firearm ownership statistics are either public surveys or the FBI's record of background checks performed annually. Unfortunately, both methods have their limitations. Surveys are subject to errors in sample selection, margin of error and the honesty of those surveyed. Background checks are performed per purchase, not per individual weapon, are only performed for weapons sold by licensed dealers and, in some states, are repeated periodically.

Recognizing that either method would provide only rough approximations, I decided using the number of background checks was the lesser of two evils and selected that approach for my analysis. The top-ten states with the highest number of background checks performed are:

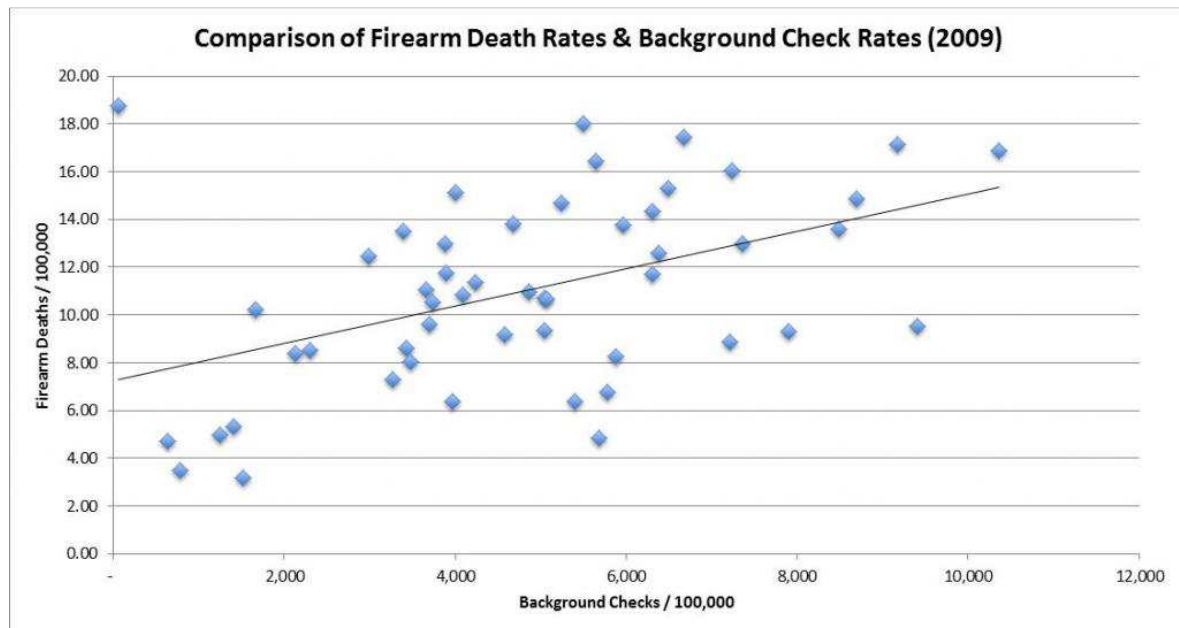
	State	2009	% of 2009 Total
1	Texas	1,014,015	8.38%
2	California	788,164	6.51%

3	Illinois	752,071	6.21%
4	Pennsylvania	641,696	5.30%
5	Florida	556,540	4.60%
6	Tennessee	408,991	3.38%
7	Ohio	395,580	3.27%
8	Georgia	373,237	3.08%
9	North Carolina	368,460	3.04%
10	Michigan	362,172	2.99%

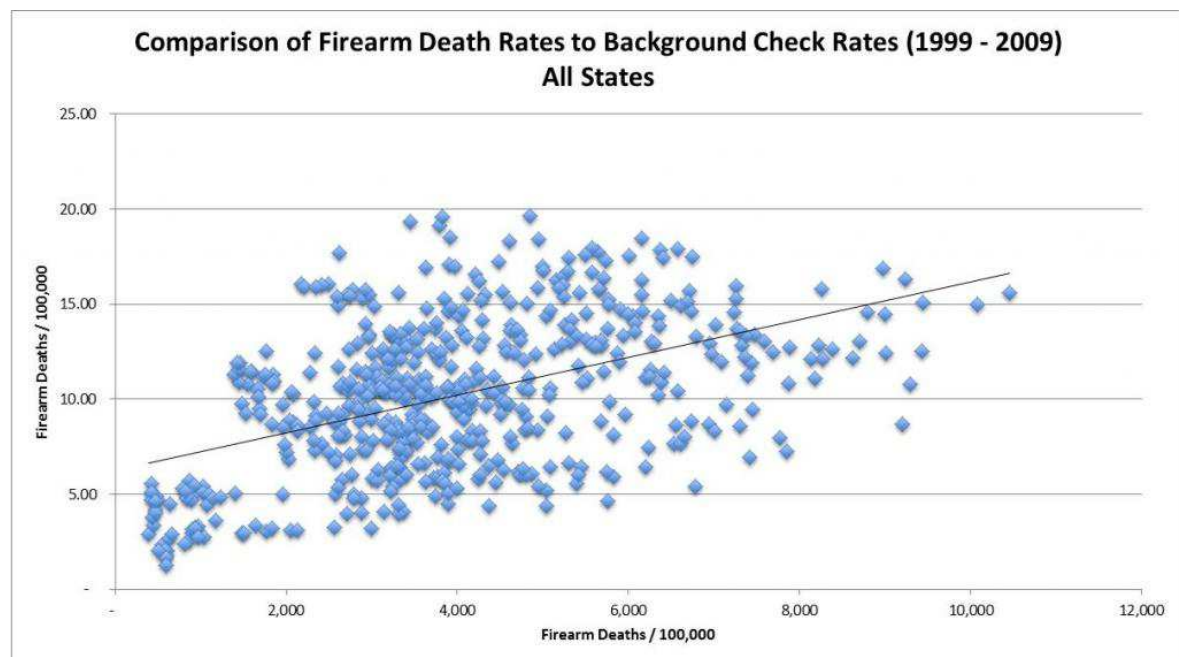
These ten states represent nearly 47% of background checks performed in the US in 2009. To represent the density of firearm ownership I calculated the number of background checks performed per 100,000 state residents. This top-ten list is a bit different:

	<u>State</u>	<u>Background Check/100,000</u>
1	Utah	9,198.40
2	Alaska	8,701.84
3	West Virginia	8,618.14
4	South Dakota	7,847.04
5	North Dakota	7,414.77
6	Kentucky	7,366.45
7	Arkansas	7,262.35
8	Alabama	6,750.64
9	Tennessee	6,495.78
10	Idaho	6,420.17

I plotted this statistic against the rate of firearm-related deaths per 100,000 state residents for 2009. The results I observed were roughly in line with the graph produced by Mother Jones:



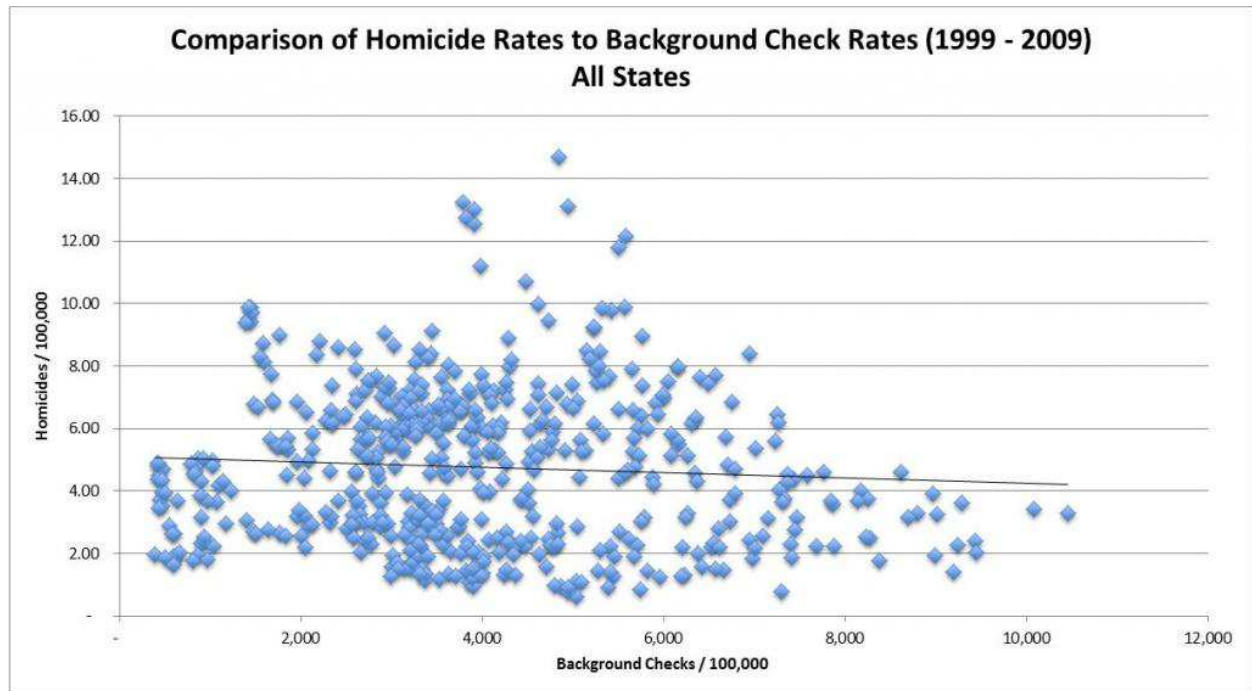
Next, I retrieved an additional ten years of data to perform this comparison for the years 1999 – 2009.



The results of this comparison were consistent with those for 2009. The correlation coefficient indicates a fairly significant increase in the death rates as the number of background checks increase. Therefore it is reasonable to conclude that the greater number of firearm purchased in a state, the more likely that state will experience more firearm-related deaths.

But my prior analyses have employed the homicide rate per 100,000 as a measure of violent crime. The firearm-related death statistic includes homicides involving firearms, but it also includes suicides, accidental deaths, deaths as a result of legal intervention and deaths of undetermined intent. I wanted

to see if there was a correlation not only between firearm ownership and firearm-related violence, but this overall measure of violence. If firearm ownership is a deterrent to violent crime, those states with higher rates of firearm ownership should experience less violent crime. The following plot compares homicide rates per state against the rate of background checks for the time period 1999-2009.



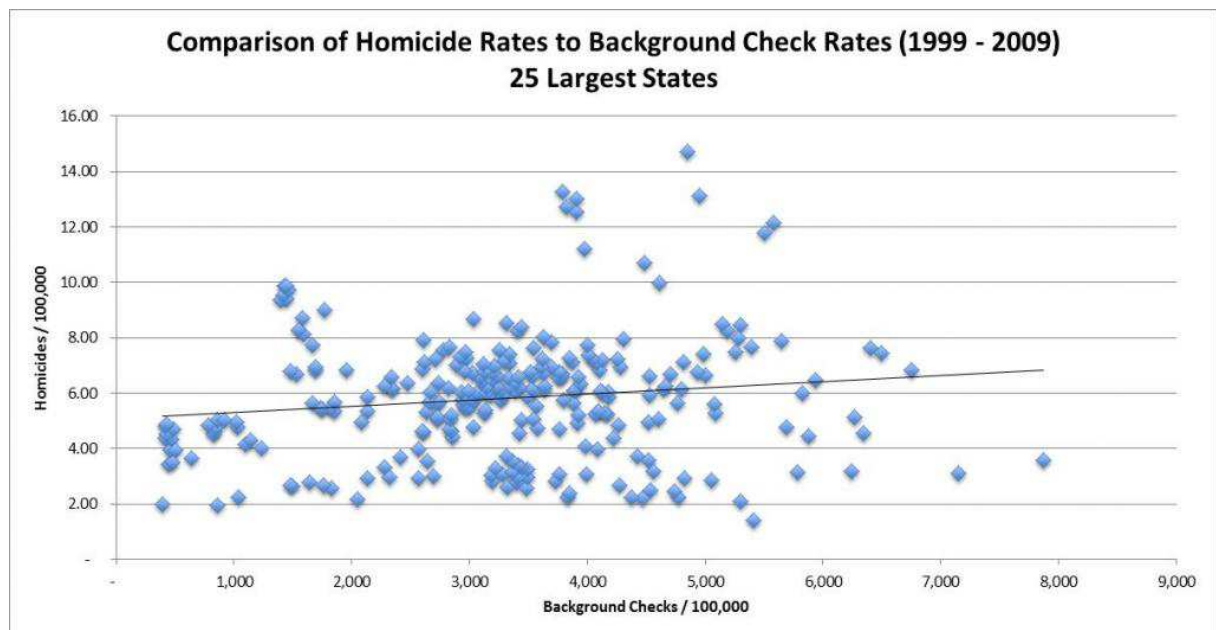
These graph indicates a very weak negative correlation between the number of background checks and rates of firearm ownership. However, because of the weakness of the correlation and the standard error of that coefficient, these results are not **statistically significant**. The distribution of data points makes it impossible to draw conclusions in either direction.

I wanted to understand which states demonstrated those characteristics that would support a negative correlation (More guns, less violence). I sorted the data set by background check rate (highest to lowest) and homicide rate (lowest to highest). The top twenty data points are:

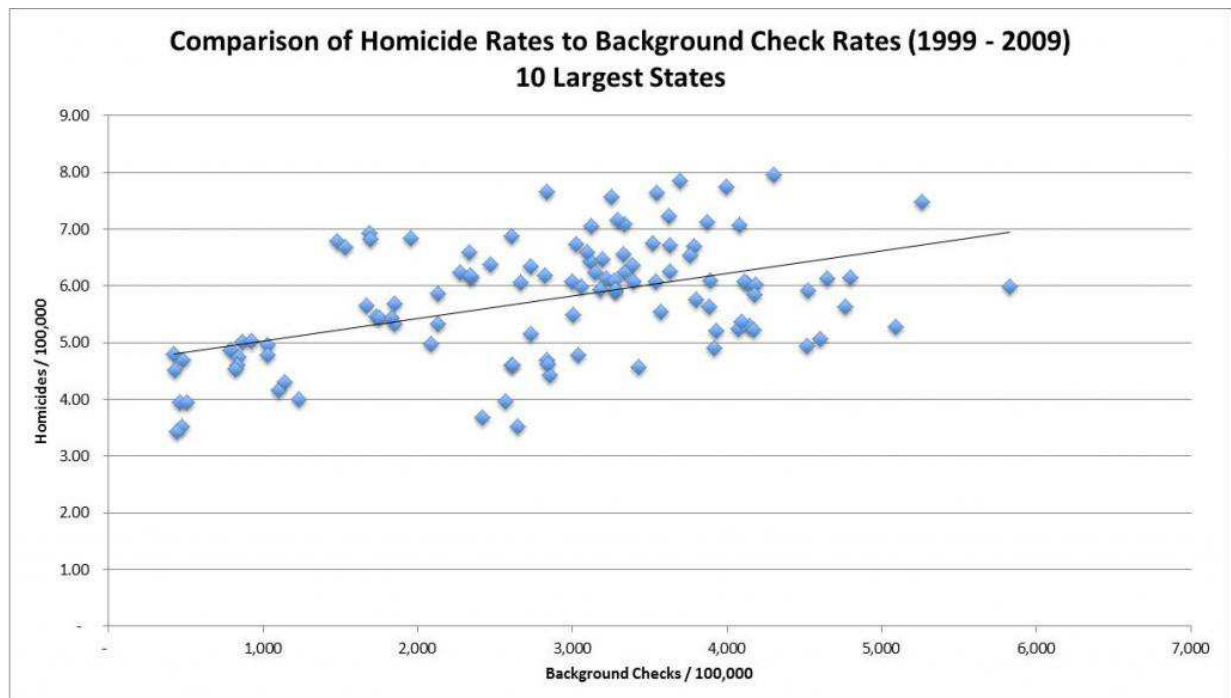
<u>Year</u>	<u>State</u>	<u>Population</u>	<u>Total Homicides</u>	<u>Total Checks</u>
2009	Montana	974,989.00	32.00	101,976.00
2008	Montana	968,035.00	33.00	97,599.00
2009	Wyoming	544,270.00	11.00	51,395.00
2007	Montana	957,861.00	23.00	90,355.00
2006	Montana	944,632.00	34.00	87,770.00
2008	Wyoming	532,981.00	12.00	49,255.00
2009	Utah	2,784,572.00	39.00	256,136.00
2004	Montana	926,920.00	30.00	83,545.00
2005	Montana	934,737.00	18.00	84,060.00

2008	Alaska	688,125.00	27.00	61,729.00
2003	Montana	918,157.00	30.00	80,786.00
2009	Alaska	698,473.00	22.00	60,780.00
2009	West Virginia	1,819,777.00	84.00	156,831.00
2002	Montana	910,372.00	16.00	76,322.00
1999	Montana	882,779.00	22.00	73,027.00
2001	Montana	905,382.00	34.00	74,752.00
2006	Wyoming	515,004.00	13.00	42,376.00
2007	Wyoming	522,830.00	21.00	42,770.00
2008	West Virginia	1,814,873.00	67.00	147,689.00
2000	Montana	902,195.00	20.00	71,115.00

The common characteristics of these states are small populations without medium to large centers of population. This introduced the question: is population a factor in the relationship of homicide rate to firearm ownership rate? To test this I generated the same plot for the twenty-five largest states. When the smaller states are excluded, the correlation becomes positive, and though it is a weak correlation, the results are statistically significant.



Next I reduced the sample to only the top ten states, by population. These states contain most of the thirty largest cities in the US over this eleven year period.



In this plot, the correlation is much stronger and the standard error smaller, indicating the results are statistically significant.

What can we conclude from this?

First, remember that I have used the number of background checks per state as a surrogate for the number of firearms per state. While I believe this is the best figure to employ, there are many reasons why it does not necessarily indicate the number of firearms in the state. Recognizing this limitation, I think it is still valid to conclude that there is good evidence of a relationship between the density of firearm ownership, firearm-related violence and the general level of violence in our larger population centers. This does not indicate a causal relationship – that firearms are a cause of violence – but it does support a hypothesis that the presence of firearms will increase the likelihood of violence occurring. It also further refutes the opinion that a more heavily armed population will reduce violence.

Last point: When I plotted the relationship between homicides and background checks for all states, the results were quite different than a similar plot of the relationship of firearm-related deaths and background checks. This was the only instance that produced markedly different results between these two statistics. Why did these results vary so much? Because of the high number of firearm-related suicides that occurred, particularly in smaller and poorer states. The suicide rate in the US is significantly higher than the homicide rate, and has not dropped as noticeably as the homicide rate has over the past few years.

The data for this analysis can be found [here](#). My thanks to [Will High](#) for his assistance with the math.

Correlation Coefficients, Sample Sizes and Standard Error for the Graphs

	All States		Top 25 States		Top 10 States	
Value	Homicides	Firearm Deaths	Homicides	Firearm Deaths	Homicides	Firearm Deaths
r	(0.066)	0.486	0.138	0.521	0.477	0.631
r²	0.004	0.237	0.019	0.272	0.227	0.399
n	550.000	550.000	275.000	275.000	110.000	110.000
SE(r)	0.042	0.033	0.059	0.044	0.074	0.058
r/SE(r)	1.542	14.925	2.326	11.856	6.440	10.962