2024

The Impact of Permit Concealed Carry and Social Factors on Firearm Fatalities

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Abstract

A tragic amount of gun fatalities occur in today's world. These fatalities can be from acts of aggression, negligence, or accidental, but nonetheless are taking lives at an alarming rate. There has been a call to action to make changes and begin combating these issues, with the most commonly proposed solution being firearm regulation. This study aimed to assess the effectiveness of firearm legislation, specifically of concealed carry regulations, on controlling firearm fatalities while also attempting to identify underlying causes or predictors of firearm fatalities. In an attempt to simplify the many regulations implemented differently between states, this study looked at concealed carry legislation as dichotomous, separating states into permitless concealed carry or permit required concealed carry states. Firearm fatalities between each group were evaluated, showing a statistically significant increase in firearm fatalities in states with permitless carry. This study also evaluated risk-taking behaviors and geographic location as potential correlations with firearm fatalities and found that excessive drinking was negatively correlated with firearm fatality rates. When assessing the predictive values of different variables, median household income was found to be the most impactful predictor of firearm fatalities. This study was limited in both scope and data and thus better serves as a catalyst for more investigation than as an absolute certainty. The evaluations of this paper are not meant to be definitive, but rather show where more specific research should be done.

Introduction

Firearm fatalities are becoming increasingly prevalent, but there is no concrete data explaining why that may be[1]. Certain firearm regulations are impactful, and socioeconomic status (SES) is strongly tied to firearm fatalities[2-7]. Other factors, such as population density and percent rurality, could potentially be correlated with firearm fatalities as well. In today's world, firearm law is a polarizing topic[8]. Some believe that further restrictions on firearm ownership will lead to less firearm fatalities while others feel that these legal restrictions do not impact firearm fatality and only make it more challenging for the general population to obtain a firearm. This study will hopefully provide a little more insight into the efficacy of gun control laws, specifically as they relate to concealed carry of a handgun, and expand on other factors that may be involved with firearm fatalities.

It would be a logical connection to say that restricting gun ownership in general should improve the adverse firearm events such as intentional and unintentional fatalities. This claim does have some merit as one study showed increased firearm restrictions have been correlated with decreased rates of firearm fatalities. Interestingly, this study showed that not all laws impact these fatality rates equally. For example, they found that more restrictive background checks did lead to a decrease in fatalities, but banning military-style assault weapons did not produce a change in firearm fatality[2]. This study shows that not all legislation impacts firearm fatalities in the same way, and the direct effect of each legislation should be further evaluated for it's impact. In this study we will be exploring legislation as it relates to concealed carry, specifically permitless carry as opposed to permit required or prohibition of concealed carry.

With the increasing number of mass firearm incidents in today's world, it might be inferred that gun legislation is becoming more restrictive. However, one study observed that the

number of states moving to less restrictive concealed carry laws is greater than the number of states restricting concealed carry laws[3]. In addition, they noted that the rates of homicides and violent crimes involving firearms did not change, even though more states were moving towards less restrictive firearm carry regulations. This finding begins to demonstrate that concealed carry legislation and negative firearm events may not be as correlated as previously thought.

States are not just becoming less restrictive in concealed carry laws, but are actually trending towards permitless carry for handguns in the United States[9]. Permitless carry, or constitutional carry, means that there would be no requirement to secure a permit or license in order to conceal a handgun on your person while in public. In one study, the authors assessed the rates of handgun permits being issued, which they found to be increasing[9]. They noted that this was likely not the full story regarding how many people were actually concealed carrying a firearm, since they could not collect data from states that were permitless, so their data likely underrepresented the number of people who were legally carrying a concealed handgun in the country. In their article, they also showed that the rise in permit issuance did not seem to change the homicide rates, and violent crimes seemed to decrease as the permit issuance rate increased[9]. Another interesting note the authors made was that individuals who followed the legalities to properly own and carry a firearm were 1/12 as likely to be convicted for a firearm related crime as police officers[9].

These studies allude to the idea that negative firearm events may not be as directly correlated with legislation as previously thought. In fact, it hints that in certain aspects, less restrictive gun laws may be more protective to society than restrictive laws would be[9]. Further studies are needed to examine what makes gun legislation more efficacious than others. Additionally, consideration should be drawn to the idea that having more citizens carrying

handguns legally could be a potential deterrent of violent crimes and homicides[9]. Finally, liberalization of gun ownership might decrease the negative connotation and stigma attached to being a gun owner, which may lead to increased education, understanding, and respect for firearms and their handling[8].

While legislation was discussed to have varying effects on firearm fatalities, conclusive observations have been made in studies on the impacts of SES. Firearm events are generally characterized as assault-related or self-inflicted, and it has been found that people who have firearm injuries are negatively correlated with their SES, especially if they are assault-related[4]. Using the Distressed Community Index (DCI), a holistic measure of an area's economic status designed by the Economic Innovation Group, relationships were also found between higher scores and gun violence[4]. The DCI scores are based on seven metrics: education, unoccupied housing, employment, poverty, income, changes in jobs, and changes in the number of business establishments[4]. Although this data only included patients with head or neck injuries, these types of injuries could be related to fatality. In fact, self-inflicted injuries were also more prone to head-specific traumas, which could result in death[4]. While the previous study showed how firearm events are associated with SES in adults, others have also found the effects of SES on children. A retrospective study suggested a positive association between DCI score and pediatric firearm events, with housing vacancy rate being the best predictor[5]. It is therefore important to recognize that firearm fatalities are not limited by age or legality, and that it requires more depth to fully elucidate the factors influencing firearm fatalities.

Along with SES, there are many other social determinants of health that relate to firearm fatalities. As the economic gap widens, it reduces an individual’s ability to move upwards economically[6]. This relationship is seen to be mediated by social mobility, which in itself has

been found to be negatively correlated with firearm-related homicides[6]. Furthermore, welfare spending and trust in institutions have been seen to impact health and mortality outcomes as well[6,7]. One ecological study referenced found that just spending $10,000 per person in poverty to support their transportation, environment, public safety, and housing was enough to decrease the average homicide rate by 16.4%[6]. When these basic needs are met, individuals are more likely to trust their institutions rather than taking matters into their own hands[6].

The effect of SES on firearm fatalities is evident, but little is known about how this could be impacted by other social factors, such as risk behaviors and population density. Risk behavior is defined as the participation in activities that may cause mental or physical harm to oneself[10]. These behaviors include, but are not limited to, smoking, drinking, unprotected sex, and substance abuse[10,11]. It is known that many risk behaviors may begin at a young age, and this has been associated with increased morbidity and mortality during both adolescents and adulthood as well as the development of other risk behaviors[10,11]. One such behavior studied was aggression, which was exacerbated by the exposure to low SES, violence, alcohol, and smoking[10]. While this relationship was identified, there was limited data on what type of aggressive behavior this included. Therefore, it was of interest for the present study to determine whether these risk behaviors may be connected to the use of firearms and firearm fatalities.

Another factor of interest for this study was population density, which has been found to be associated with owning and using firearms, but its impacts on firearm fatality is still unknown. Based on a previous study, 72% of adults who grew up in rural communities had a gun in their household, whereas this value was less in suburbs (37%) and cities (39%)[8]. Of the adults who currently own a gun, there were generally more for people who grew up in a gun-owning household than not, regardless of population density[8]. However, this difference was most

pronounced in rural communities, where 48% of adults who grew up with guns now own a gun compared to the 12% who now own a gun but did not grow up with them[8]. Among gun owners in urban, suburban, and rural areas, the majority of gun owners in all areas responded that their primary reason for owning a gun was for protection, but in addition to protection, rural gun owners were also more likely to own a gun for the purpose of hunting[8]. With the data provided by this study, it was found that rural communities tend to have a greater percentage of gun owners in their population compared to other, denser communities[8]. Despite this relationship, how this affects firearm fatalities have yet to be discovered.

Based on previous studies, there are still mixed conclusions on whether regulations positively or negatively impact firearm fatalities. Therefore, it is necessary to look at additional factors to make reasonable correlations. For this study, analysis was performed to identify differences in firearm fatalities in states with permitless carry regulations compared to those without (RQ 1). Analysis was also done to look at how firearm fatalities compared between states with the same regulation type (RQ 2). To further assess how concealed carry regulations affect firearm fatality rates, these rates were compared before and after the legalization of permitless carry within specific states (RQ 3). Firearm concealed carry regulations are not the only factors in play, so to evaluate social factors, adult smoking (RQ 4), excessive drinking (RQ 5), and percent rurality (RQ 6) were also compared with firearm fatality rates. Finally, to identify any potential predictive factors, median household income, adult smoking, excessive drinking, and percent rurality and permitless carry status were evaluated with firearm fatality rates (RQ 7).

Methods

All data used in this study are from the 2017 and 2022 data set of County Health Rankings (CHR), a program that provides county data and examples from all states of the United States of America to bring awareness to the factors influencing health and to support leaders in improving the community and health equity. The data was processed through IBM SPSS Statistics. For the purposes of this study, states were grouped based upon a summary article on concealed carry permit[9]. A state labeled as "constitutional carry" indicates the ability for its residents to have a concealed carry without a permit, while a state labeled as "right-to-carry" or "may-issue" indicates the requirement for a permit before a concealed carry is allowed. Since Louisiana was considered "partial constitutional carry", it was difficult to group into one type of regulation, so this state was excluded (Supplement Table 1).

For RQ 3, where concealed carry regulation changes within specific states were addressed, only counties with data for both of the years-of-interest were considered. The specific states chosen for this question were Idaho, Mississippi, Missouri, and West Virginia, as their firearm regulations changed from requiring a permit for concealed carry to permitless carry in 2016, and this was a year that CHR had data for. The data sets selected for this question were 2017 and 2022, which used data from 2011-2015 (before regulation change) and 2016-2020 (after regulation change) respectively.

Descriptions of how each data value was gathered and measured by CHR is listed below:

Firearm fatalities were determined by mortality files gathered from the National Center for Health Statistics and National Vital Statistics System. Values were measured by number of deaths due to firearms per 100,000 population. Using this CHR data, each state's firearm fatality

averages were calculated based on their county's firearm fatality to avoid disproportionate representation if comparing permitless carry and permit requiring counties, since some states could have significantly less counties than others. With the state firearm fatality averages and the firearm carry status groups formed based on the aforementioned criteria, an unpaired t-test was performed to identify differences in firearm fatalities in states with permitless carry compared to those that required a permit (RQ 1). This was followed by a Z-test to identify how firearm fatalities compared between states with the same carry status (RQ 2). To further see how concealed carry regulation affects firearm fatality rates, a paired t-test was performed using the counties of the four states who moved to permitless carry in 2016 (RQ 3). Specifically, the paired t-test compared the 2017 data of the counties within the selected four states to their 2022 data. Additional paired t-tests were done by splitting the counties into their corresponding states to see the individual effects of the regulation change based on states.

Adult smoking and excessive drinking were both measured by the Behavioral Risk Factor Surveillance System, which is a state-based random digit dial telephone survey. Adult smoking values were based on the percentage of adults who were current smokers (age-adjusted). Excessive drinking values were based on the percentage of adults reporting binge or heavy drinking (age-adjusted). County data from both adult smoking (RQ 4) and excessive drinking (RQ 5) were compared with their respective firearm fatality county data using Pearson correlation tests, since both the smoking and drinking data were identified to be normally distributed on a histogram.

Percent rurality was found through Census Population Estimates. County data for percent rurality (RQ 6) was compared to county data for firearm fatality through a Spearman correlation test, since the percent rurality data was identified to be not normally distributed on a histogram.

For RQs 4, 5, and 6, three correlation tests were done to address each question. Each of the questions included a correlation between the social factors of interest and firearm fatalities of the counties within all states, only the states with permitless carry, and only the states with permit required carry.

Median household income data was measured by Small Area Income and Poverty Estimates. The living wage data was determined from the Living Wage Calculator. Median household income is the value where half of households in a county earn more and half of households earn less. Living wage is the hourly wage needed to cover basic household expenses plus all relevant taxes for a household of one adult and two children. Using the county level data for this, the carry status of each state, and all the adult smoking, excessive drinking, and percent rurality data gathered from above, a regression analysis was performed with firearm fatality to identify any potential predictive factors (RQ 7).

Results

The firearm fatality rates were significantly lower in states with permit required carry (18.21) compared to those with permitless carry (12.54) in 2022 ($t = 3.55$, $p < 0.001$) (Table 1).

Comparing firearm fatality rates only between permitless carry states, although none of their firearm fatality rates varied from one another enough to be an outlier (Z-score ± 3), there were still important variances seen, as shown by the range of Z-scores and scores greater than ± 2. This pattern was also observed in the permit required carry states (Supplement Table 2-4).

Table 1: Firearm Fatality Rates Between States With or Without Permitless Carry in 2022

Permitless Carry	n	Mean	SD
Yes	27	18.21	4.89
No	22	12.54*	6.28

Abbreviation: SD, Standard Deviation

*p < 0.001 compared to Yes Permitless Carry

When viewing the effects of moving to permitless carry within Idaho, Mississippi, Missouri, and West Virginia during 2016, there was a significant increase in firearm fatality rate from 17.03 to 20.60 ($t = -8.58$, $p < 0.001$) (Table 2). However, it is worthy to note that when states were analyzed individually, Idaho did not show a significant change in firearm fatality rate while the other three all had a significant increase (Supplement Table 4-7).

Table 2: Firearm Fatality Rates Before and After Moving to Permitless Carry in 2016 in Selected States

Data Set	n	Mean	SD
2017	208	17.03	6.06
2022	208	20.60*	7.66

Abbreviation: SD, Standard Deviation

*p < 0.001 compared to 2017

A Pearson correlation showed a weak positive correlation (n = 2209, r = 0.498, p < 0.001) (Figure 1) between smokers and firearm fatality rates in all states, which did not change based on the carry status. Therefore, states with permitless carry also had a weak positive correlation (n = 1343, r = 0.362, p < 0.001) (Figure 2), similar to states with permit required carry (n = 866, r = 0.402, p < 0.001) (Figure 3).

Figure 1: Correlation Between Firearm Fatality Rates and Adult Smokers in All States

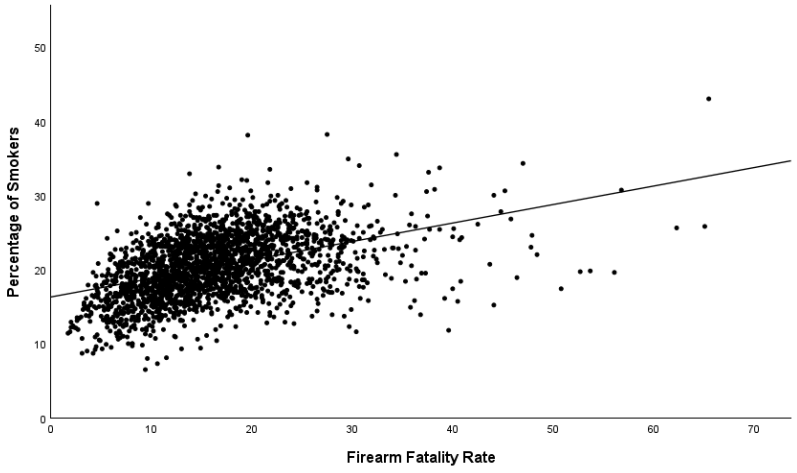


Figure 2: Correlation Between Firearm Fatality Rates and Adult Smokers in States With Permitless Carry

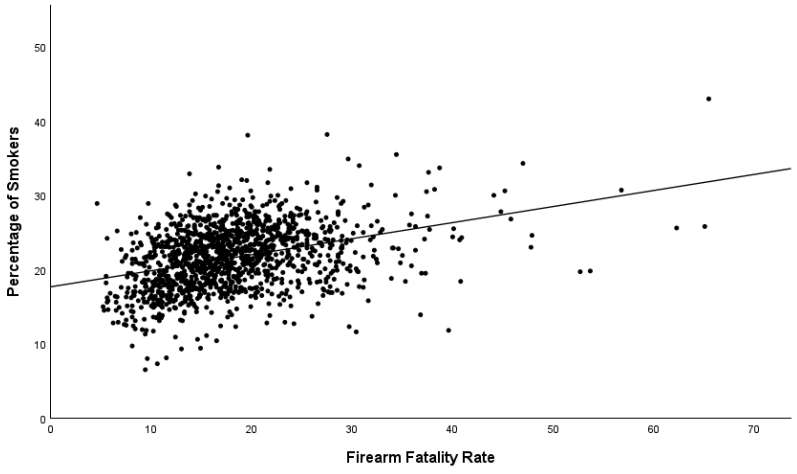
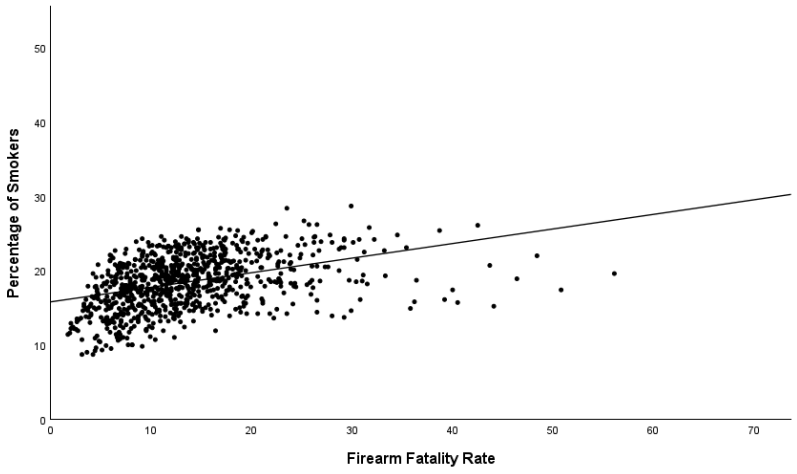


Figure 3: Correlation Between Firearm Fatality Rates and Adult Smokers in States With Permit Required Carry



Here, a Pearson correlation showed a weak negative correlation ($n = 2209$, $r = -0.411$, $p < 0.001$) (Figure 4) between the percent of excessive drinking and firearm fatality rates in all states, which did not change based on state carry status; permitless carry ($n = 1343$, $r = -0.332$, $p < 0.001$) (Figure 5) and permit required ($n = 866$, $r = -0.336$, $p < 0.001$) (Figure 6).

Figure 4: Correlation Between Firearm Fatality Rates and Excessive Drinking in All States

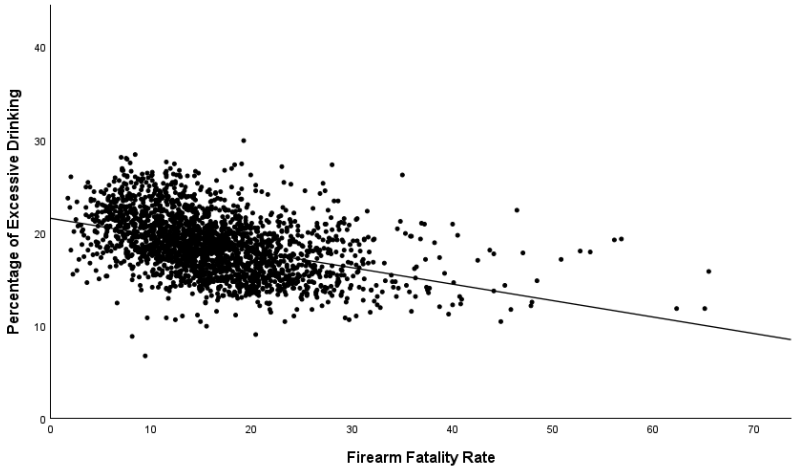


Figure 5: Correlation Between Firearm Fatality Rates and Excessive Drinking in States With Permitless Carry

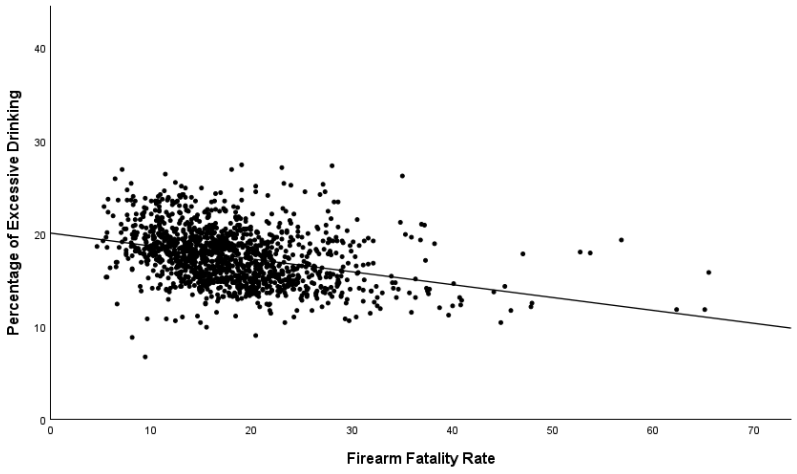
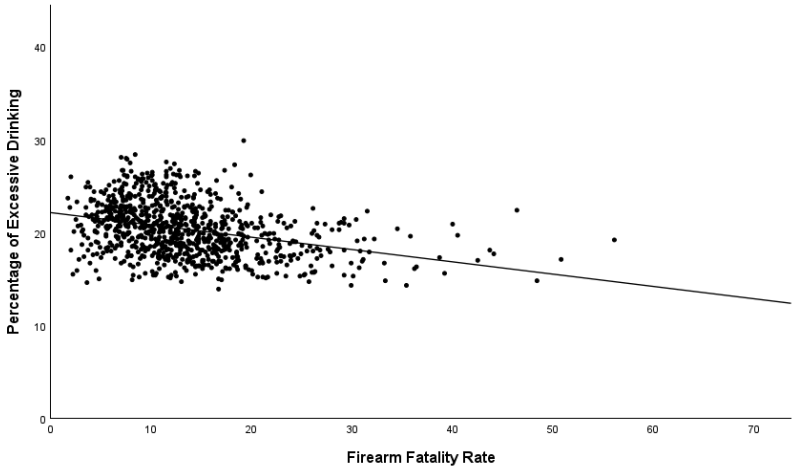


Figure 6: Correlation Between Firearm Fatality Rates and Excessive Drinking in States With Permit Required Carry



Finally, using a Spearman correlation, there was a weak positive correlation ($n = 2207$, $r = 0.392$, $p < 0.001$) (Figure 7) between percent of rural residents and firearm fatality rates in all states. States with permitless carry ($n = 1341$, $r = 0.364$, $p < 0.001$) (Figure 8) and states with permit required carry ($n = 866$, $r = 0.392$, $p < 0.001$) (Figure 9) both followed this trend.

Figure 7: Correlation Between Firearm Fatality Rates and Percent Rurality in All States

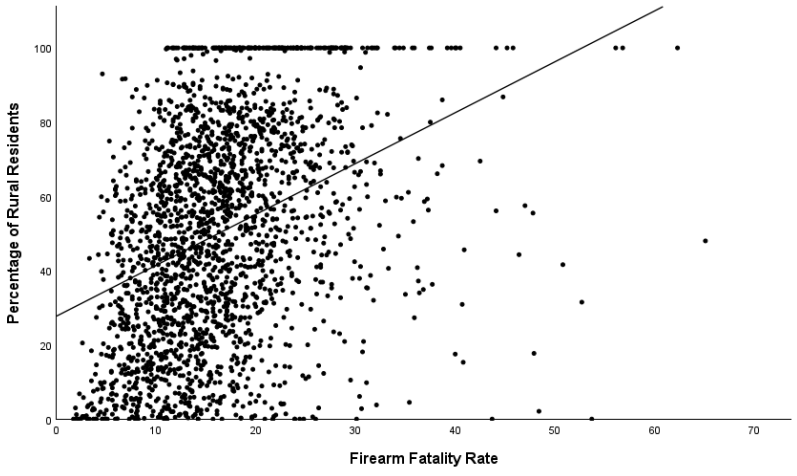


Figure 8: Correlation Between Firearm Fatality Rates and Percent Rurality in States With Permitless Carry

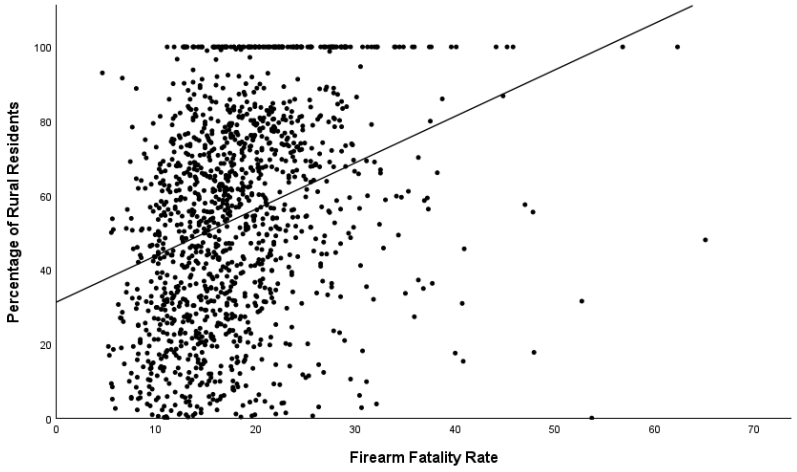
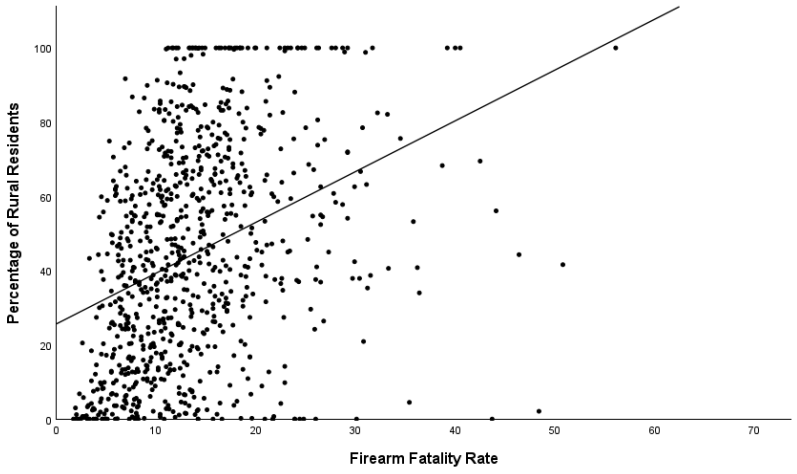


Figure 9: Correlation Between Firearm Fatality Rates and Percent Rurality in States With Permit Required Carry



The last research question asked if median household income, excessive drinking, percent smokers, percent rural residents, or carry status predicted the firearm fatality rates. The best fitting model of the stepwise linear regression analysis was significant ($F_{5,2201} = 234.17$, $p < 0.001$) and accounts for 34.6% of variance. The regression showed that median household

income was the strongest contributor (B = -0.00019, t = -14.91, $p < 0.001$) followed by excessive drinking (B = -0.49, t = -10.44, $p < 0.001$), then percent rural (B = 0.046, t = 8.26, $p < 0.001$), concealed carry status (B = -1.42, t = -4.75, $p < 0.001$), and finally adult smoking (B = -0.12, t = -2.45, p = 0.014).

Discussion

To summarize the findings, concealed carry status had a statistically significant impact on firearm fatality rates. Specifically, states with permitless carry (constitutional carry) were seen to have more firearm fatalities than those with permit required carry (right-to-carry or may-issue). States within the same group of having either permitless carry or permit required carry did not display any outliers in firearm fatality rates from one another. When looking at firearm fatality rates before and after moving to permitless carry status, there was a statistically significant increase in firearm fatality rates in general. However, when looking at each state individually, one state (Idaho) was identified to not follow this trend. When comparing firearm fatality rates to social variables such as percent smokers, excessive drinking, and percent rurality, weak correlations were determined regardless of regulation type. Finally, median household income was shown to be most predictive of firearm fatality rates, followed by excessive drinking and percent rurality respectively. Interestingly, these three factors were stronger predictors of firearm fatality than the carry status of the state, as this was listed fourth in the linear regression. Smoking was the least predictive factor in the regression model. While only weak correlations were found between the social factors and firearm fatality rates, the positioning of these factors above carry status in the regression model may suggest that other factors have more influence on the firearm fatality rate than firearm regulation changes alone. This should be considered for further investigation to provide better guidance when developing future firearm regulations.

The first question addressed through this research was how firearm fatality rates compared between states with permitless carry compared to permit required carry. As previous research has suggested, more restrictive gun laws, such as requiring background checks, could lead to an overall decrease in firearm fatalities[2]. However, more recent studies have also shown

that reduced restrictions did not change the firearm fatality rate at all[3,9]. With the controversy between the effects of regulations on firearm fatality rate, it was difficult to make a prediction for the data presented in this study. After analysis, it was determined there were significantly lower amounts of firearm fatalities in states with permit required carry than those with permitless carry. This directly supports the pattern seen by some studies and suggests that regulations do provide some form of protection against firearm fatalities[2].

Other sources may have found differing results due to different approaches of data acquisition and organization. For example, one study presented their data as murder rates and violent crime rates for anyone with a permit, but the impacts of having permits in varying states and regulations were not assessed[9]. Other differences may arise from how the states were sorted based on their types of concealed carry policies. The present study only included two groups, permitless carry and permit required carry, but other studies have presented data with more specific designations, such as “no carry”, “may issue”, “shall issue”, “unrestricted carry”, and “right-to-carry”[3,9]. With more specific groups, the results seen in this study may become less apparent, so further investigations are required to elucidate this difference.

Knowing that even states with similar carry status could have widely different populations and environmental factors, it became interesting to see whether states within the same group of regulations would have similar firearm fatality rates. It was hypothesized that with similar firearm regulations, firearm fatalities within states of the same group should not differ significantly from one another even with the presence of other factors. Although the analyses did demonstrate that no rates were so different from one another that they were considered outliers within their respective concealed carry status groups, the data did show that large variances between states with the same type of regulation still exist.

Environmental factors definitely play a role here, but this discrepancy between states could also suggest that firearm policies made within each state could be different even if they fall under the same carry status category. This idea is supported by a study where they described the legislation's effect on firearm fatality, but also identifies the need to better understand how the implementation or repealing of firearm control laws actually impacts the community affected[12]. For example, restrictive laws such as the one mentioned earlier that included background checks could reduce firearm fatality rates, but laws enforcing education and training with firearms could change the rate differently even though this would still be considered restrictive.

Next, seeing that concealed carry regulations do have an impact on firearm fatality rates, this pattern was checked more directly by making a comparison of how policy changes within a state affected their rates. An assessment of Idaho, Mississippi, Missouri, and West Virginia showed that overall, the change to permitless carry does correlate significantly with increased firearm fatality rates. What was also interesting to note was when analyzing the states individually, Idaho was the only state that did not show a significant difference in firearm fatality rate. This could have been due to the greater proportion of “100% rural” counties (based on percent rurality data) in Idaho, which unfortunately all lacked firearm fatality rate data for analysis, compared to Mississippi, Missouri, and West Virginia, which had some representation from “100% rural” counties. Consequently, Idaho had a smaller sample size compared to the other three states, and with a population density far less than the others, a change in concealed carry regulations may not have seen as big an effect per county. While the overall impact of policy changes supports what was seen for the first question, it once again hones in on the idea that regulations do play an important role in determining firearm fatality rates, but it is not the only factor. The specific regulation policy and how it is enforced hugely dictate how the rate

changes[12]. What is also crucial to recognize, however, is the role of social factors on firearm fatality rates.

To address the impacts of social factors, comparisons were determined between firearm fatality rates to percent smokers and excessive drinking as a way to compare firearm fatality rates to different risk behaviors. It was predicted that firearm fatality rates would directly increase proportionately with both smoking and drinking, but this was only true for the smoking. The analysis of the data showed an inverse relationship to excessive drinking and firearm fatality rates. Justification for this finding may be more deeply tied to psychology, perhaps indicating that those who drink tend to find communities and belonging as opposed to smoking, which tends to be less of a social activity. However, from a social economic and risk-taking perspective, the difference in firearm fatality correlation in smokers vs drinkers does not seem immediately apparent and likely warrants more focus in further research.

Exploring social factors further, the relationship between firearm fatality and percent rurality was hypothesized to be inversely proportional. This prediction was made on the premise that rural culture holds a higher emphasis on gun ownership due to hunting and protecting crops and livestock from predators, which leads to less stigma about firearms and more comfort and respect with handling them[8]. The analysis showed a minimal correlation with percent rurality, indicating that rural and urban environments alike did not show preference for firearm fatalities.

Finally, certain factors were explored in an effort to predict firearm fatality rates. The analysis showed median household income as the greatest predictor of firearm fatality rates. This supports the findings of the correlation between DCI and firearm fatality rate found in previous studies[4,6]. This finding indicates that SES may be a great influencer in firearm fatalities and could be a potential target of intervention on the firearm fatality epidemic being faced by the country.

Excessive drinking and percent rurality also contributed to the predictability of firearm fatality rates. However, given the negative correlation seen with excessive drinking and the minimal correlation with percent rurality, more investigation into these areas should be done to better understand how they influence firearm fatalities. Interestingly, these three factors proved to be more predictive of firearm fatalities than the concealed carry status of the state, which was ranked fourth out of five factors in its predictive value to firearm fatality rates, followed only by percent smokers. This strongly hints at the idea that firearm regulations alone cannot fully control firearm fatality rates and that the individual needs of the community need to be assessed if we want to most effectively reduce firearm fatalities.

The social factors chosen in this study were limited to the data that was available on CHR, which limited the scope of study. While the factors chosen do provide insight on possible social factors driving the firearm fatality rates, it may be necessary to explore these factors in different contexts as well as exploring other associated factors altogether. Additionally, the complexity of regulations makes it difficult to truly define the type of firearm policies within each state and to compare states to each other. In this study, the data used had simplified regulations to states that had constitutional carry and states that had permit required carry. Constitutional carry in this study was defined as any state that did not require a permit in order to concealed carry a weapon. This is an incredibly broad and oversimplified way of classifying a very complex topic. Further research should be conducted on individual laws to truly assess the functionality of regulations at an individual and gross level.

Furthermore, when comparing firearm fatality rates before and after moving to permitless carry, only four states were assessed due to the available data on CHR. Only selecting four states provided a very small sample size that cannot be well translated to the rest of the country. It is

possible that isolated and unique factors influenced the effectiveness of the regulation changes in each of these states which may be providing a misleading concept of how these regulation changes may actually affect firearm fatality rates in other states. Future studies could explore more states that have pre and post constitutional carry law data to allow for a better understanding of the true impact of constitutional carry on firearm fatalities.

Lastly, the main data source, County Health Rankings, used datasets which consisted of several years worth of data that were compiled and averaged to provide data for an individual year. This could mean that the before and after data used were skewed by data sets overlapping the change of regulation or from the numbers being averaged across multiple years. To address this in future studies, a different source of data that is more narrow and specific could be used, perhaps from state or hospital records.

Laws and regulations seem to be a main source of intervention on the firearm fatality epidemic. However, this paper aimed to show that there are numerous factors impacting firearm fatalities, yet the depth and degree to which these factors influence firearm fatalities are not well understood. Others have shown data that indicates laws may not be the most effective method at controlling firearm fatalities and that various socioeconomic and social determinants may contribute. It is necessary to continue to explore the underlying pathology of the firearm epidemic and treat it at its source socially and environmentally, rather than at surface level alone with regulation. The data in this study did not show strong correlations with social factors and it contradicted some ideas behind the liberalization of gun regulations based on the four states that were assessed. However, due to some of the limitations in this study, no strong conclusions should be drawn until more research is done on both the influence of environmental factors and the outcomes that individual laws have on firearm fatality.

Citations

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Supplemental Information

Supplement Table 1: Permitless Carry Status for States Based on Firearm Legislation in 2022[9]		
State	**Firearm Legislation**	**Permitless Carry**
Alabama	Constitutional Carry	Yes
Alaska	Constitutional Carry	Yes
Arizona	Constitutional Carry	Yes
Arkansas	Constitutional Carry	Yes
California	Right-to-Carry	No
Colorado	Right-to-Carry	No
Connecticut	Right-to-Carry	No
Delaware	May-Issue	No
Florida	Constitutional Carry	Yes
Georgia	Constitutional Carry	Yes
Hawaii	May-Issue	No
Idaho	Constitutional Carry	Yes
Illinois	Right-to-Carry	No
Indiana	Constitutional Carry	Yes
Iowa	Constitutional Carry	Yes
Kansas	Constitutional Carry	Yes
Kentucky	Constitutional Carry	Yes
Louisiana	Partial Constitutional Carry	Excluded
Maine	Constitutional Carry	Yes
Maryland	Right-to-Carry	No
Massachusetts	Right-to-Carry	No
Michigan	Right-to-Carry	No

Supplement Table 1: Permitless Carry Status for States Based on Firearm Legislation in 2022[9]		
State	**Firearm Legislation**	**Permitless Carry**
Minnesota	Right-to-Carry	No
Mississippi	Constitutional Carry	Yes
Missouri	Constitutional Carry	Yes
Montana	Constitutional Carry	Yes
Nebraska	Constitutional Carry	Yes
Nevada	Right-to-Carry	No
New Hampshire	Constitutional Carry	Yes
New Jersey	May-Issue	No
New Mexico	Right-to-Carry	No
New York	May-Issue	No
North Carolina	Right-to-Carry	No
North Dakota	Constitutional Carry	Yes
Ohio	Constitutional Carry	Yes
Oklahoma	Constitutional Carry	Yes
Oregon	Right-to-Carry	No
Pennsylvania	Right-to-Carry	No
Rhode Island	Right-to-Carry	No
South Carolina	Right-to-Carry	No
South Dakota	Constitutional Carry	Yes
Tennessee	Constitutional Carry	Yes
Texas	Constitutional Carry	Yes
Utah	Constitutional Carry	Yes
Vermont	Constitutional Carry	Yes

Supplement Table 1: Permitless Carry Status for States Based on Firearm Legislation in 2022[9]		
State	**Firearm Legislation**	**Permitless Carry**
Virginia	Right-to-Carry	No
Washington	Right-to-Carry	No
West Virginia	Constitutional Carry	Yes
Wisconsin	Right-to-Carry	No
Wyoming	Constitutional Carry	Yes

Supplement Table 2: Z-Scores for States With Permitless Carry in 2022	
State	**Z-Score**
Alabama	0.98
Alaska	2.90
Arizona	0.39
Arkansas	0.77
Florida	-0.55
Georgia	0.01
Idaho	0.33
Indiana	-0.98
Iowa	-1.50
Kansas	-0.40
Kentucky	0.14
Maine	-0.93
Mississippi	1.20
Missouri	0.23
Montana	1.21

Supplement Table 2: Z-Scores for States With Permitless Carry in 2022	
State	**Z-Score**
Nebraska	-1.29
New Hampshire	-1.21
North Dakota	-0.58
Ohio	-1.21
Oklahoma	0.40
South Dakota	-0.34
Tennessee	0.08
Texas	-0.45
Utah	0.04
Vermont	-1.01
West Virginia	0.52
Wyoming	1.25

Supplement Table 3: Z-Score for States Without Permitless Carry in 2022	
State	**Z-Score**
California	-0.14
Colorado	1.16
Connecticut	-1.11
Delaware	-0.25
Hawaii	-1.21
Illinois	-0.39
Maryland	-0.22
Massachusetts	-1.33

Supplement Table 3: Z-Score for States Without Permitless Carry in 2022	
State	**Z-Score**
Michigan	0.03
Minnesota	-0.42
Nevada	1.71
New Jersey	-1.11
New Mexico	2.04
New York	-0.98
North Carolina	0.66
Oregon	0.79
Pennsylvania	0.03
Rhode Island	-1.29
South Carolina	1.51
Virginia	0.60
Washington	0.15
Wisconsin	-0.24

Supplement Table 4: Firearm Fatality Rates Before and After Moving to Permitless Carry in 2016 in Idaho			
Data Set	**n**	**Mean**	**SD**
2017	24	16.17	6.63
2022	24	17.89	6.48
Abbreviation: SD, Standard Deviation			

Supplement Table 5: Firearm Fatality Rates Before and After Moving to Permitless Carry in 2016 in Mississippi

Data Set	n	Mean	SD
2017	66	19.70	6.46
2022	66	23.88*	8.22

Abbreviation: SD, Standard Deviation

*p < 0.001 compared to 2017

Supplement Table 6: Firearm Fatality Rates Before and After Moving to Permitless Carry in 2016 in Missouri

Data Set	n	Mean	SD
2017	74	15.12	4.50
2022	74	19.05*	6.74

Abbreviation: SD, Standard Deviation

*p < 0.001 compared to 2017

Supplement Table 7: Firearm Fatality Rates Before and After Moving to Permitless Carry in 2016 in West Virginia

Data Set	n	Mean	SD
2017	44	16.73	6.17
2022	44	19.78*	7.41

Abbreviation: SD, Standard Deviation

*p < 0.001 compared to 2017