

**CONCEALED CARRY OF FIREARMS IN THE UNITED STATES: A PUBLIC
HEALTH LAW ANALYSIS OF STATE POLICY AND STATE SUICIDE
MORTALITY**

by
Alexander D. McCourt, JD, MPH

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Abstract

Although research has shown that some laws governing the concealed carry of firearms are associated increased violent crime, the relationship between these laws and suicide mortality has not been rigorously evaluated. This dissertation's three studies sought to examine this relationship.

The first study gathered and analyzed concealed carry laws for all 50 states from 1980–2017, revealing trends toward deregulation of concealed carry. The results describe state concealed carry policy, concluding that while broader access to firearms facilitated by concealed carry laws may increase suicide risk, specific permitting requirements may provide opportunities for preventive interventions.

The second study sought to determine whether shall issue and permitless laws—the laws that make it easiest to carry a concealed firearm—affect suicide mortality. Suicide mortality data from 1980–2015 were collected from the National Center for Health Statistics. The primary independent variables were shall issue laws and permitless laws. The statistical analysis consisted of negative binomial models with state fixed effects and synthetic control methods. The analysis found no relationship between shall issue laws and suicide. Laws allowing permitless carry had a harmful effect on suicide, but this result is limited by the small number of states with permitless laws before 2015.

The third study sought to determine whether specific elements of concealed carry permitting laws are associated with suicide mortality. The data were identical to the second study, but the independent variables were laws requiring training, a good cause for a permit, and applicant suitability. The statistical analysis consisted of negative binomial models with state fixed effects and synthetic control methods. States requiring

training saw decreased suicide. This effect may, however, be limited to states with the most restrictive concealed carry laws. Good cause and suitability requirements had no consistent relationship with suicide.

Overall, this dissertation research found that concealed carry is being increasingly deregulated in the United States. Though the loosest permitting laws are not broadly associated with suicide mortality, states allowing permitless carry may see increased suicide. Training may help prevent deaths by suicide in certain contexts. These courses represent a promising point of intervention for suicide prevention efforts.

Advisor: Daniel Webster, ScD, MPH
Readers: Holly Wilcox, PhD
Jon Vernick, JD, MPH
Mary Cwik, PhD
Alternates: Cassandra Crifasi, PhD, MPH
Elizabeth Stuart, PhD
Joanna Cohen, PhD

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INTRODUCTION

Suicide mortality and firearms are intimately linked. Access to firearms increases the risk of death by suicide.¹ Homes with guns are more likely see the suicide of a household member than homes without guns.^{2,3} Firearms are also the most lethal means of self-harm, with a case fatality rate near 90%.^{4,5,6} The close relationship between firearms and suicide risk points to the need for policy schemes designed to limit firearm access for high-risk people.⁷ Researchers and policymakers should evaluate state and federal laws to determine whether existing frameworks are associated with or are even exacerbating the risk of firearm suicide.

Prior studies have found that permit-to-purchase (PTP) laws are associated with lower suicide rates.⁸ Broadly, these laws require a prospective purchaser to acquire a permit prior to purchasing a firearm. The permitting process for the concealed carry of firearms is very similar. Most states require a permit to carry a concealed weapon. A state's permitting process falls into one of three general categories: (1) shall-issue, in which the permitting body must issue a permit to anyone that meets the baseline criteria; (2) may-issue, in which the permitting body has some discretion as to whether to issue a permit to an applicant, even if the baseline criteria are satisfied; and (3) no permit required, in which no permit is required for legal possessors to carry a concealed weapon.

Although the relationship between concealed carry permitting and violent crime has been studied and hotly debated, the association between concealed carry permitting and suicide has yet to be rigorously studied. Because concealed carry permits facilitate access to firearms and access to firearms is a risk factor for death by suicide, the

association between the two must be evaluated. This dissertation seeks to analyze the development and current status of concealed carry laws and to evaluate whether these laws, or any key statutory elements, are associated with suicide risk.

BACKGROUND AND LITERATURE REVIEW

Suicide and the Role of Firearms

Suicide is the 10th-leading cause of death in the United States. In 2016, according to the National Center for Health Statistics, there were nearly 45,000 deaths by suicide. The overall suicide mortality rate has generally increased over the last 17 years, though the use of firearms has generally decreased.^{9,10} Despite the overall decrease in the rate of firearm usage, firearms were still the most common suicide method in 2016.⁹ Firearms were implicated in 56.6% of male deaths by suicide. Among females, firearms were used in slightly less than a third of deaths (31.9%).¹¹

There are many risk factors for suicide, including family history, previous suicide attempts, history of mental disorders, access to lethal means, and others.¹² Access to firearms increases the risk for death by suicide.^{1,13} Suicides account for 63% of all firearm-related deaths and, overall, approximately 50% of suicides are committed with a firearm.¹¹ Research has shown that, after controlling for other risk factors, suicide deaths are more likely to occur in homes with firearms than in homes without firearms.^{2,3} Overall, states with higher rates of firearm ownership have higher rates of both firearm-specific suicide deaths and overall suicide deaths.¹⁴ These findings suggest that exposure to firearms may enhance the risk of death by suicide.

One mechanism by which firearm exposure enhances the risk of death by suicide is firearm lethality. Compared to other means of intentional self-harm—including

poisoning, suffocation, falls, and cutting or piercing—firearms have the highest case fatality rate. Multiple studies have placed the case fatality rate close to 90%, while the rate for suffocation—the next highest rate among the most common lethal means—is around 70%.^{4,5,6} The differences in means-specific lethality are important because they are relatively stable across demographic groups. What varies across groups is the prevalence of a given lethal method. For example, females are more likely to attempt suicide, but males are much more likely to die by suicide. This is largely due to differences in methodology—men are more likely to use highly lethal means, including firearms, than are women.^{5,6,15}

Despite the many varying risk factors for death by suicide, the lethality of firearms plays an outsized role in the mortality rate and heightens the risk associated with other risk factors. Suicide research has consistently found that approximately 90% of individuals who survive a suicide attempt will not ultimately die by suicide.¹⁶ Individuals are more likely to survive a suicide attempt if the lethality of their chosen means of self-harm is low. Thus, not only are firearms immediately more lethal, but, those who opt for other means of self-harm are less likely to ever die by suicide than those who use firearms. A prior suicide attempt is, nonetheless, still a risk factor for suicide. Although only a small proportion of those who previously attempt suicide will ultimately die by suicide, this proportion is still much greater than the proportion of the total population who die by suicide.¹⁷

Because the mode of suicide attempt is so influential, clinicians often provide lethal means counseling to high-risk patients. Several national organizations, including the American Academy of Pediatrics and the American College of Physicians, have

recommended that clinicians offer specific guidance on firearm risks and safe-storage practices.^{18,19,20} Despite these recommendations, some physicians are hesitant to advise patients about firearms. Physicians' concerns are cultural and legal. Some physicians do not want to offend patients who may perceive the counseling as inappropriately political. These physicians are concerned that they will lose patients or, relatedly, that patients in need of care will eschew medical appointments to avoid conversations about firearms. Other physicians worry their advice will conflict with firearm storage and transfer laws.^{21,22,23}

Cultural competency training has been proposed as a solution to the sociocultural concerns,²¹ but the legal concerns are slightly more complicated. Some states have tried to limit what physicians can ask patients about, but these laws are incredibly controversial.²⁴ The most prominent example is Florida's physician gag law, which was recently struck down by the Eleventh Circuit Court of Appeals.²⁵ These laws trigger concerns about the First Amendment rights of doctors and the medical field's ability to establish evidence-based standards of care.²⁴

In addition to laws specifically targeting physician behavior, a state's overall firearm statutory scheme may affect the content and implementation of lethal means counseling. States that strictly regulate firearm transfers through background checks and other laws may be indirectly inhibiting the ability of patients to temporarily transfer firearms to reduce the risk of suicide.⁷ For example, a state with rigorous background check requirements for private sales may require that an individual experiencing suicidal ideation seek a background check on a neighbor before giving the firearm to her for

safekeeping. Because suicide is so often an impulsive act,²⁶ any delay in reducing access to lethal means could prove fatal.

Research demonstrating the impulsivity of suicidal actions reveals the inadequacy of suicide prevention strategies that rely primarily on temporary transfers following lethal means counseling. In one study, 24% of individuals who made “near-lethal suicide attempts took less than 5 minutes between the decision to act and the attempt. 70% took less than an hour.^{4,26} Because such a large proportion of suicide attempts are impulsive, evaluation of access to lethal means is extraordinarily important. Because firearms are so lethal, ready access to a firearm is likely to enhance the likelihood that an impulsive suicide attempt will be fatal, while diminishing the opportunity for clinical or legal intervention. Because firearm availability is so intimately tied to death by suicide, firearm laws may affect suicide rates. Any potential association between firearm laws and suicide is of particular relevance for states, across which firearm laws vary in important ways.

Firearm Laws

Firearms are regulated at the federal and state level. Most firearm laws are state statutes, though these are often framed within the federal regulatory infrastructure. Both state and federal laws are cast against the background of the Second Amendment: “A well regulated Militia, being necessary to the security of a free State, the right of the people to keep and bear Arms, shall not be infringed.”²⁷ The Second Amendment has played an increasingly powerful role in social and political discourse over the last ten years.

In 2008, the Supreme Court of the United States held that the Second Amendment guarantees an individual right to possess a firearm for “traditionally lawful purposes.”²⁸

In that decision, *District of Columbia v. Heller*, the Court held that Washington, D.C.'s handgun ban and trigger-lock requirement violated the Second Amendment. This decision contained the Court's first holding that the Amendment conferred an individual right.²⁸ Because D.C. is a federal district, this decision only limited the actions of the federal government. Two years later, in *McDonald v. City of Chicago*, the Court held that the Due Process Clause of the Fourteenth Amendment incorporates the Second Amendment, which means that state governments must also protect the individual right conferred by the Second Amendment.²⁹

Though these two cases recognized an individual right, they also recognized that this right, "like most rights . . . is not unlimited."²⁸ In fact, the majority opinion states that the holding should not "be taken to cast doubt on longstanding prohibitions on the possession of firearms by felons and the mentally ill, or laws forbidding the carrying of firearms in sensitive places . . . or laws imposing conditions and qualifications on the commercial sale of arms."²⁸ Thus, despite the Court's unprecedented articulation of the right, the justices maintained that state and federal policymakers can still rigorously regulate firearms.

Federal law prohibits certain categories of persons from purchasing or possessing firearms. These prohibited persons include individuals convicted of a felony, domestic violence misdemeanants, individuals subject to domestic violence restraining orders, persons involuntarily committed to mental healthcare institutions, and others.³⁰ One of the primary mechanisms for enforcing these prohibitions is a background check. Under federal law, a background check is required when an individual seeks to purchase a firearm from a federally licensed firearm dealer.³⁰ States can either conduct their own

background checks or have the Federal Bureau of Investigation (FBI) handle the checks.³¹ These background checks are intended to prevent sales to individuals prohibited from possessing firearms, but there are significant gaps. Federal law does not require a background check for private sales. Though most sales likely occur through a federally licensed dealer, a sizable percentage of firearm transactions occur in the private market.³²

Private sales are governed by state law. 18 states, including California,³³ Maryland,³⁴ and Illinois,³⁵ require some form of background check prior to a private sale. These state schemes generally take one of two forms: Permit to Purchase (PTP) or CBC checks at the point of sale (generally termed a “comprehensive background check” (CBC) law). Broadly, PTP states require a prospective purchaser to obtain a permit prior to purchasing a firearm. The permitting process involves a background check.³⁶ CBC states require a background check at the point of sale. These are generally facilitated by a federally licensed dealer or law enforcement.^{34,35} The remaining states do not require background checks for private sales.

Each state has its own law concerning the concealed carry of firearms. While no state bans concealed carry entirely, there are a variety of regulatory schemes. The state laws can be sorted into 3 categories: May issue, shall issue, and no permit required. The category names refer to the ease with which the permits allowing individuals to carry a concealed weapon are issued. Historically, there have been states with “no issue” laws, but no state currently has such a strict law. Most states fall into the middle category, with some form of a shall issue law. Under both may issue and shall issue laws, there are baseline requirements that each applicant must meet. These are similar to the baseline

requirements for passing a federal background check for purchase of a firearm from a federally licensed dealer, although some states have instituted additional requirements like a training class or a showing of proper purpose. In states without a concealed carry permit requirement, the only restrictions on concealed carry are the baseline state and federal restrictions on firearm purchase and possession.

Between states issuing concealed carry permits, the key differences are in the level of discretion afforded the issuing body. Permits are generally issued by law enforcement. In states with may issue laws, the issuing bodies have broad discretion. Even if an applicant meets the baseline requirements, the issuing body can consider other factors when deciding whether to issue a permit. Many may issue statutes will require the issuing body to determine whether the applicant has a good reason for the permit or whether the applicant has “good moral character.” These determinations afford the issuing body a fair amount of latitude in determining whether to issue a permit. There are 8 states with may-issue laws.

Shall issue laws require issuing bodies to grant a permit to any applicant that meets the baseline requirements. The baseline eligibility criteria might include age limits (e.g., 21 or older), a lack of felony or certain misdemeanor convictions, a showing of firearm proficiency, or other, similar, requirements. Thirty states have shall issue laws

The remaining 12 states do not require permits to carry a concealed weapon. Shall issue and permitless laws are often termed “Right to Carry” (RTC) laws. Many states with permitless laws still have a mechanism for obtaining a permit. These mechanisms may seem superfluous, but exist for two important reasons. First, in any state, an individual seeking to purchase a firearm from a federally licensed dealer does not have to

undergo a federal background check if: 1) the individual has a valid concealed carry permit that was issued within 5 years of and in the same state as the purchase and; 2) the state requires a background check before receiving the permit.³⁰ Second, many states recognize permits issued in other states. This may be because the state does not require a permit or because the state has entered into a reciprocal agreement to recognize permits from other states. Recently, there has been a push to establish nationwide reciprocity. If this law is enacted, all states would have to recognize concealed carry permits issued in other states.³⁶ This would have the effect of universally lowering the permitting standards. States that lack permit requirements may maintain permitting mechanisms so permit holders can purchase firearms from licensed dealers without a point-of-sale background check and to facilitate interstate travel with a concealed weapon.

Although there are only three broad categories of concealed carry permitting schemes, state-by-state requirements and processes vary quite a bit. This is true of most state gun laws, which has facilitated research into certain effects of those laws.

Firearm Laws' Effect on Crime and Health

Firearm research is limited by political and financial constraints,³⁷ but existing research shows a definite link between weak gun laws and higher rates of firearm-related mortality. Some of the most effective laws are those that require a permit or point-of-sale background check for private purchases. Specifically, PTP laws have been associated with decreases in gun violence and crime. In 1995, Connecticut enacted a PTP law and in 2007 Missouri repealed a PTP law. Analyses of both laws found that PTP laws have a protective effect. In Connecticut, the law was associated with reductions in firearm homicides and suicides.^{8,38} Missouri, however, saw increases in firearm homicides and

suicides after the repeal.^{8,39} In addition, Missouri began seeing increased diversion of purchased guns to criminals and a rise in the share of crime guns originating in the state instead of other states.⁴⁰

The effect of PTP laws is important to understanding the potential effect of concealed carry permitting laws. Concealed carry permitting is similar to the PTP process—many of the same restrictions exist and background checks are an instrumental component. There are important differences in scope, however. A permit to purchase only confers the ability to legally purchase a firearm. A concealed carry permit, however, allows holders to purchase firearms and carry them in a concealed manner in many public places. It is conceivable, then, that concealed carry laws may have a slightly different effect than PTP laws.

Most of the research on concealed carry laws has focused on crime. Politically, concealed carry permits are highly contentious. “RTC laws” are at the center of the “more guns, less crime” hypothesis.⁴¹ The most robust research, however, has found that the studies supporting this hypothesis are faulty and, in fact, that RTC laws may have the opposite effect. Researchers have found that RTC laws are associated with higher rates of violent and property crime.^{42,43} The mechanism for this increase is somewhat unclear. It is not necessarily the case that concealed carry permit holders are responsible for increases in crime. However, the mere presence of firearms in otherwise contentious or dangerous scenarios may increase the risk for violent crime. The key mechanisms have not yet been determined in part because permit information is confidential in most states.⁴⁴

The relationship between concealed carry schemes and suicide rates has not been adequately studied. If the risk of death by suicide is elevated by exposure to firearms, laws that facilitate the public carrying of firearms may increase that risk. Concealed carry permitting schemes may also affect suicide risk because these permits facilitate firearm purchases. If there is no direct relationship between concealed carry permits and suicide risk, shall issue laws may still contribute to a normative environment that discourages lethal means restrictions and counseling. PTP laws affect firearm suicide rates, which suggests that concealed carry laws may have a similar effect. Even if the effect of concealed carry permitting on suicide is minimal, however, analysis of the relationship fills an important research gap. A fuller understanding of the relationship between firearms and suicide will help researchers and policymakers craft evidence-based suicide prevention strategies.

CONCEPTUAL FRAMEWORK

The Public Health Law Research model is a useful tool for structuring this dissertation. The model connects lawmaking with population health outcomes and identifies points for both research and intervention. The authors of the model use a three-part typology to describe public health law: interventional, infrastructural, and incidental law. Interventional laws are meant to affect health outcomes directly (or through mediators). Infrastructural laws establish public health institutions and articulate their duties and powers. Incidental public health laws are those that affect population health, whether they were intended to or not.⁴⁵ Public health law research often grapples with laws on multiple fronts.

In the context of public health law research, firearm laws—and concealed carry laws in particular—are unquestionably interventional public health laws. They are directly intended to prevent access to firearms by high-risk individuals to reduce firearm-related injuries and deaths and related crimes. The laws are also incidental, however, because there are health-related consequences to the laws and the associated practices. For example, many laws intended to lower firearm crime rates—specifically homicide—may also affect suicide risk. These incidental effects have not received as much attention.

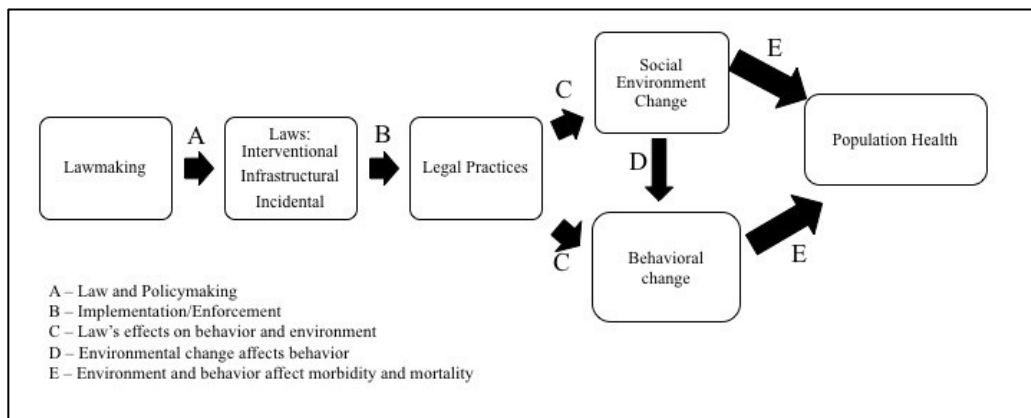


Figure A

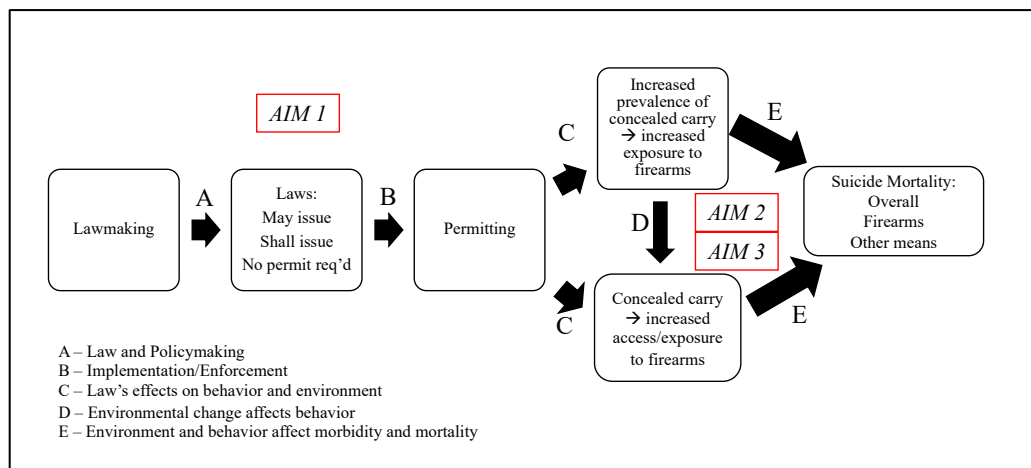


Figure B

Figure A displays the underlying Public Health Law Research Logic Model. Figure B applies the model to the proposed research.

The PHLR model connects laws to legal practices through implementation and enforcement, which is an underappreciated and difficult-to-measure aspect of public health law. Litigation challenging the validity of a law often focuses on either the text—the law itself—or the application of the law—the manner in which it is enforced. Inadequate, biased, or overly rigorous enforcement of a law can have an impact on that law’s effect on the population. Legal practices are shaped by the implementation choices made by regulatory agencies, law enforcement, and other authorities. These practices, in turn, shape behavior. Behavior can be shaped directly (path C in the figure) or through changes to the environment. This indirect path is most easily understood through a prototypical public health law issue: Laws intended to develop and beautify green spaces may spur increased physical activity by expanding the available physical environment. Environmental changes can also be social in nature (e.g., the creation of rights or privileges). Changes to environment and behavior will affect population health.

The relationship between concealed carry laws and suicide fits neatly into the PHLR model. The ability to legally carry a concealed weapon is determined by baseline restrictions on firearm purchase and possession, concealed carry permitting requirements, and place-based carry restrictions. These laws have not necessarily been implemented simultaneously, but they each affect concealed carry practices. The stringency of these laws varies considerably across states and is most evident in the implementation and enforcement stage. This is most apparent for concealed carry laws, which afford permitting entities different levels of discretion.

The importance of implementation in permitting is best explained through a hypothetical. If two states, A and B, have the same baseline permit requirements, a

cursory evaluation might conclude that the states have similar permitting schemes. However, if state A has a shall issue law—affording the permitting body no discretion—and state B has a may issue law—affording the permitting body discretion to evaluate other factors—the ultimate permitting schemes are quite different. In state A, every applicant who meets the baseline requirements will receive a permit. In state B, however, irrespective of the statutory permit requirements, there will be a subset of applicants who are not issued a permit because they are deemed high-risk or unsafe. In other words, some of the successful applicants in state A would be unsuccessful in state B. This difference in implementation is key because it likely affects both the demographics of and the prevalence of high-suicide-risk characteristics in the pool of permit holders.

The demographics and prevalence of high-risk characteristics in a pool of concealed carry permit holders are elements of both the social environment and behavioral pieces of the PHLR model. It is at this point that the PHLR model links with the larger conceptual framework of suicide. Access to lethal means is a key part of any analysis of suicide. Concealed carry laws—and firearm laws, generally—influence an individual’s access to lethal means. States with less stringent concealed carry permitting schemes are more likely to have larger, higher-risk pools of permittees than states with stricter laws. States with larger, riskier pools are likely to see higher rates of suicide because more high-risk individuals may have ready access to lethal means.

Concealed carry laws may also affect suicide risk by expanding spatial access to lethal means. Concealed carry permits allow permit holders to carry concealed firearms in many public places. Although there are some states that allow open carry of firearms in these same places without a permit, there are still many states that bar any public carrying

without a permit. States that grant concealed carry permits to higher-risk individuals and states that allow permitless open or concealed carry are expanding the time and space in which individuals are exposed to lethal means. Thus, concealed carry laws may affect suicide risk not just through access to firearms, but also through an expansion of the locations in which an individual has access to lethal means. Because suicidal actions are often impulsive, the availability of lethal means in public spaces is an important consideration. In sum, relatively lax concealed carry laws may increase the risk of death by suicide generally and the risk of self-inflicted injury outside the home.

RESEARCH QUESTIONS AND HYPOTHESES

AIM 1

Research Question: How do state carry laws differ, and, in light of existing research, what are the public health implications of these differences?

Each of the research aims fits neatly into the conceptual model offered in the previous section. The first aim asks what important differences exist between state concealed carry permitting schemes. This question implicates the “laws” box in the conceptual model. The key variations will include differences in specific requirements like training, good cause, and suitability. Current state laws will likely vary considerably with respect to their overarching scheme and their specific requirements, but this analysis will reveal that there several common threads that may affect suicide risk.

AIM 2

Research question: Do states with shall issue or permitless laws see increased suicide mortality?

This aim asks whether a state with a shall issue or permitless concealed carry permitting scheme has elevated firearm suicide and overall suicide rates as compared to states with more flexible schemes. This aim will focus primarily on the tail end of the conceptual model (path “D”) by seeking to evaluate the relationship between state legislation and suicide mortality. States without a permitting requirement and states with a shall issue law will have elevated rates of firearm suicide mortality and overall suicide mortality. These states, particularly those revealed to have high exposure in Aim 2, will have elevated rates because their laws facilitate access to firearms, which is a risk factor for death by suicide. In addition, research has already shown that these laws are associated with elevated crime rates, which suggests that these laws do influence behavior.⁴⁴

States with relatively flexible firearm laws likely have a normative environment that will further contribute to elevated gun possession and use and suicide mortality. State laws and implementation strategies that facilitate broader access to firearms—both across risky populations and across public spaces—will affect environmental and behavioral change that elevates risk. Firearms will be more prevalent in the physical environment and access to firearms will expand, particularly for permit holders.

AIM 3

Are specific permitting requirements like training, good cause, and suitability, associated with suicide mortality?

This aim asks whether specific permitting requirements are associated with changes in state suicide mortality. Specifically, it investigates three requirements: training, articulating a good cause for a permit, and that the applicant is “suitable” to be

permitted. This analysis will focus primarily on the tail end of the conceptual model (path “D”) by seeking to describe evaluate the relationship between specific state permitting requirements and suicide mortality. Each of these three requirements seeks to ensure that individuals who legally carry concealed firearms present a low risk for violence. In general, they are not intended to address suicide risk. Like the overarching permitting schemes, however, these requirements have a direct effect on firearm access and exposure. These requirements are likely associated with decreases in suicide mortality. States that require applicants to articulate a good reason for carrying a concealed weapon or that ensure the applicant is “suitable” to be licensed are, at a minimum, decreasing the number of successful applicants. Training, in particular, not only adds another requirement to the process, but also helps ensure that all successful applicants are exposed to safe storage and use practices.

This dissertation proceeds in several parts. Manuscripts for each of three aims follow this introductory section. A chapter integrating the findings of the three analyses follows the third manuscript. In the Appendix after the main text, there is an appendix detailing the public health law and statistical methods used in this research. Finally, this document concludes with an Appendix of tables and figures.

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**REGULATION OF CONCEALED CARRY IN THE UNITED STATES: A
PUBLIC HEALTH LAW RESEARCH ANALYSIS OF STATE PERMITTING
LAWS AND SUICIDE RISK**

ABSTRACT

Access to firearms is a key risk factor for death by suicide. Though concealed carry laws may facilitate broader access to firearms, they have not been sufficiently evaluated. This research seeks to fill that gap by engaging in a public health law research analysis of concealed carry laws in the United States. Using a standard legal epidemiology approach, this paper provides a detailed explanation of state concealed carry policy, concluding that states have significant constitutional flexibility in regulating concealed carry and that while the broader access to firearms facilitated by concealed carry laws may increase suicide risk, specific permitting requirements, like training courses, may provide opportunities for suicide-preventive interventions.

INTRODUCTION

Firearm violence is a particularly difficult public health problem. An effective, evidence-based policy intervention should address gun violence primarily and facilitate programmatic, community interventions. Each aspect of a firearm regulatory scheme should be evaluated with respect to its intended and unintended consequences. Even laws primarily intended to address interpersonal violence or crime should be evaluated for any unintentional effect on suicide.

Suicides account for more than half of firearm-related deaths.¹ Though there are many risk factors for suicide, access to lethal means—particularly firearms—is extraordinarily important.² Suicide deaths are more likely to occur in homes with

firearms, and, in general, states with higher rates of firearm ownership have higher rates of overall suicide and firearm-specific suicide than states with lower rates of ownership.^{3,4,5} Firearm lethality is an influential mechanism underlying the relationship between firearms and suicide. Research has consistently shown a case fatality rate near 90% for suicide attempts with a firearm. This rate is much higher than rates for other lethal means like suffocation, poisoning, and falls.^{6,7,8} Because individuals who survive suicide attempts are unlikely to ultimately die by suicide, those individuals who choose non-firearm means are less likely to ever die by suicide than those who opt for firearms.⁹

The close relationship between firearms and suicide, coupled with the fact that the majority of firearm deaths are suicides, points to a need to analyze all firearm laws for their effect on suicide. Laws that regulate access to firearms will necessarily have an effect on suicide mortality. Research has already demonstrated a relationship between purchase- and ownership-based restrictions and suicide.¹⁰ This study focuses on a different piece of firearm regulation—concealed carry.

Laws governing the concealed carry of firearms are some of the oldest firearm laws in the U.S.,¹¹ but they have evolved such that there is significant variation across states.¹² Some state laws make it quite easy to carry a concealed weapon. Others make it very difficult and allow only a select few to legally carry. Over the last 30 years, these laws have been at the center of local, state, and national policy debates.¹³ Most of the fight has centered on crime, with the debunked “more guns, less crime” hypothesis playing a central role.^{14,15} This study seeks to fill two gaps in the concealed carry literature. First, most scholarship has simplified concealed carry laws into categories defined by the ease with which a state resident can carry a concealed firearm. This study

expands upon that classification by describing how current laws have evolved over the last several decades and by providing a detailed overview of specific state requirements underlying these broader categories. Second, this study explores these laws through a suicide-conscious lens, using existing theory and literature to examine the hypothesis that concealed carry laws may increase suicide risk, but may also provide opportunities for unique interventions.

METHODS

This study used a standard legal epidemiology approach. Each state's concealed carry laws were retrieved from the Thomson Reuters Westlaw ("Westlaw") database. Laws relevant to concealed carry policy were pulled from each state's code using a series of standard search terms^a and manual searching. The legislative history of each of these statutes was obtained from Westlaw and HeinOnline. Each state's overall concealed carry law was tracked from 1980 to 2017. Specific legal requirements were also collected including training, suitability, age, and other criteria.

Once the state laws were categorized and mapped, they were collectively evaluated for two suicide-related measures: 1) the ability of a state's legal scheme to limit firearm exposure for those at risk of death by suicide; and 2) whether the legal scheme provides opportunities for preventive intervention.

CONCEALED CARRY LAWS IN THE UNITED STATES

While firearm sales are regulated at both the federal and state level, concealed carry is almost exclusively regulated by state governments. Most states require a permit to carry a concealed firearm, though the requirements for obtaining a permit vary. In

^a These search terms included "conceal*", "gun or firearm", "carry", "permit or license", and others.

general, state concealed carry laws can be sorted into 4 categories defined by the broad permit requirements. Under “no issue” laws, concealed carry is banned and permits are not issued. Under “permitless” laws, concealed carry is allowed without a permit. No application process is required. The remaining two categories of laws—“shall issue” and “may issue”—allow concealed carry, but only with a valid permit. The key difference between these two categories lies in the permitting process. Both types of law have statutory requirements that applicants must meet, but the laws differ with respect to the level of discretion afforded the state in making permitting decisions. In general, states with shall issue laws must issue a permit to any applicant who meets the statutory criteria. In states with may issue laws, the state has broad discretion—even if an applicant meets all of the statutory criteria, the state may deny the application.

All states currently allow concealed carry, but this was not always the case. In 1980, there were 21 states that banned concealed carry entirely. An additional 24 states had may issue laws. In total, 45 states either prohibited concealed carry or had a selective permitting process. Only 4 states had shall issue laws: Indiana, New Hampshire, Rhode Island, and Washington. Vermont was the lone state that allowed permitless concealed carry (Table 1).

By 1990, not much had changed—the majority of the country either banned concealed carry or had may issue laws. There was, however, a slight shift toward shall issue laws. There were now only 16 state with no issue laws. Colorado, Tennessee, and Wyoming had adopted may issue laws. Maine and North Dakota had switched from no issue to shall issue. Florida, Georgia, Oregon, Pennsylvania, South Dakota, and West Virginia replaced may issue laws with shall issue laws. This minor shuffle left 21 states

with may issue laws and 12 states with shall issue laws, but still just Vermont allowing permitless carry. Despite these changes, most of the country was still governed by restrictive concealed carry policy.

Over the next decade, there was a dramatic shift. Only 7 states still had no issue laws and the number of states with may issue laws had been cut nearly in half to 13. The number of states with shall issue laws exploded, jumping from 12 in 1990 to 29 in 2000. Vermont was still the only state that allowed permitless carry. From 2000 to 2010, state laws continued the swing toward shall issue. By 2010, there were 36 states that had shall issue laws. The number of may issue states had decreased to 10 and the number of states banning concealed carry had dwindled to two—Illinois and Wisconsin. In 2003, Alaska adopted a law allowing permitless carry and in mid-2010 Arizona would as well.

From 2010 to 2017 the shift toward laws facilitating concealed carry continued, but in a slightly different way. Wisconsin (2011) and Illinois (2014) both adopted shall issue laws. The number of may issue states settled at 8: California, Connecticut, Delaware, Hawaii, Maryland, Massachusetts, New Jersey, and New York. The number of states with shall issue laws actually decreased, falling to 30, but the number of states allowing permitless carry increased dramatically. As of July 2010, there were 3 states that allowed permitless carry. By the end of 2017, 12 states had such a law.

In 1990, there were 37 states with either may issue or no issue laws. By 2017, the nation's regulation of concealed carry had flipped almost entirely—42 states now have either shall issue laws or allow permitless carry. Though no study has examined the causes for this shift, it is important to note that the “more guns, less crime” hypothesis rose to prominence in the late 1990s.¹⁶ Rigorous analyses have since debunked this

theory, but it is plausible that this theory nonetheless led advocates and state legislatures to push for more permissive regulation of concealed carry. No matter the impetus, states undoubtedly did shift toward more permissive regulatory schemes between 1990 and the present.

In addition to these major shifts in overall concealed carry policy, specific statutory application requirements have also undergone some changes (Table 2). Some states require applicants to demonstrate a good reason or cause for carrying a concealed weapon. State law might require that an applicant articulate a specific threat to herself or her family or it may be sufficient for an applicant to prove that her job carries inherent danger. The number of states with a “good cause” requirement peaked at 19 between 1986 and 1989. By 2000, the number had decreased to 14 and by 2017, to 11.

State laws requiring a determination as to the “suitability” of an applicant have also decreased in popularity. These laws typically require a state to determine whether an applicant is a “suitable” person to be licensed. This may mean that the state has to evaluate the “moral character” of an applicant,¹⁷ a process that could require an applicant to provide letters of reference from community members.¹⁸ In states like Indiana, the statute leaves the process for evaluating “good character” somewhat nebulous, perhaps requiring only that the state investigate the “applicant’s official records.”¹⁹ The type of narrow discretion afforded by a suitability requirement is distinct from the type of broad discretion afforded by a may issue law. In shall issue states with a suitability requirement, discretion is limited to this single aspect of the application process. In most cases, it is also limited to the specific statutory process for determining suitability. In a may issue state, with or without a suitability requirement, the state’s discretion is comprehensive.

Currently, there are 13 states with a suitability requirement, down from 18 in 2000 and 21 in 1980.

Training requirements have grown in popularity. In 1980, only 3 states—New Jersey, South Carolina, and West Virginia—required training as part of the permitting process. Each of these states also had a may issue law. By 1990, the number of states requiring training had increased to 9. Over the next decade, alongside the shift from no issue and may issue to shall issue, 17 more states added training requirements, bringing the total to 26. As of 2017, the number of states requiring training sits at 31—81.6% of all states requiring permits.

Training requirements, while more common now than in 1980, vary quite a bit. Some states have specific training requirements listed in their statutes. Delaware, for example, requires applicants to take a course covering knowledge and safe handling of firearms, safe storage and child safety, knowledge and safe handling of ammunition, safe storage of ammunition, safe firearm shooting fundamentals, federal and state firearm laws pertaining to purchase, ownership, transportation, use, and possession, state self-defense laws, techniques for avoiding a criminal attack, and how to manage a violent confrontation, including conflict resolution.¹⁸ Other states do not specify specific course requirements, either leaving the specifics to law enforcement²⁰ or to private entities.²¹ Only 18 states require the live fire of a gun as part of the application process (Table 2).

These requirements—training, danger analysis, suitability, and good cause—vary the most between states and are particular to carry permitting. Among states requiring permits, there are provisions that apply in almost every state. These include age minimums (generally ranging from 18 to 21), bans for individuals convicted of felonies

or certain misdemeanors, bans for subjects of domestic violence restraining orders, bans for individuals adjudicated mentally incapacitated or involuntarily committed for mental health care, and bans for substance abusers. Not only are these regulations common across state concealed carry policies, but they are often included in state and federal laws governing firearm purchase and ownership. It is generally true, then, that individuals prohibited from purchasing or possessing a firearm are prohibited from obtaining a concealed carry permit. The concealed carry regulations outlined in the preceding paragraphs are not, in general, part of purchase and ownership regulations. If, for example, a person could not obtain a concealed carry permit because she could not provide a good cause for carrying a concealed weapon or because she failed to complete the required training, she might still be eligible to purchase and possess firearms.

In addition to specific permitting requirements, there are two elements of concealed carry policy that are essential to understanding the regulation of concealed weapons in the U.S.: background check alternatives and reciprocity agreements. In general, individuals seeking to purchase firearms from a federally licensed dealer must undergo a background check.²² There are important exceptions to this requirement. In many states, a valid concealed carry permit, issued after a background check, qualifies as a background check alternative.²³ A person carrying such a permit is exempt from the background check requirement for firearm purchases.

Concealed carry reciprocity agreements between states facilitate the carrying of concealed weapons across state lines. Some states do not recognize permits issued by any other state,²⁴ while other states have near-universal reciprocity, recognizing valid permits from any state.²⁵ States that limit reciprocity often do so because their permitting

standards are more robust than other states. States that allow permitless carry often offer permits to its citizens so they can qualify for the background check exception and reciprocity.

In 2017 and 2018, nationwide reciprocity was considered in Congress. Under the proposed bill, states would have been required to recognize any valid permit from any other state. In addition, states that otherwise require permits would have been required to allow residents of permitless states to carry without a permit. This bill has not yet made it through both houses of Congress.²⁶

CONCEALED CARRY AND THE SECOND AMENDMENT

In mapping state concealed carry policy and identifying elements that might promote or endanger public health, it is important to understand the applicable constitutional infrastructure. For firearm laws, this means grappling with the Second Amendment. It is instructive to consider two eras of firearm regulation and Second Amendment jurisprudence: before *Heller* and after *Heller*.

Concealed carry regulations are some of the oldest firearm laws in the U.S. In fact, laws banning the carry of hidden firearms were upheld as far back as the 1800s.^{12,27} As the previous section describes, states continued to make concealed carry difficult through 1980. Bans and other limits were rarely held to violate the Second Amendment and where they were held to violate similar state constitutional provisions, states changed their constitutions to allow the regulation of concealed carry.^{12,28}

Legal scholars debate whether the Second Amendment confers a collective or individual right, but until 2008 courts had generally adhered to the collective rights theory. Under this theory, the Second Amendment protects a state right—the right to a

“well-regulated militia.”²⁹ In 2008, the Supreme Court opted instead for the individual rights theory, holding that the Second Amendment guaranteed the individual right to bear arms for lawful purposes, specifically self-defense in one’s home.¹¹ The Court subsequently held that the Second Amendment bound state action as well.³⁰ Justice Scalia, writing the majority opinion in *Heller*, acknowledged the problem of American gun violence and noted that the right was not absolute—“nothing in our opinion should be taken to cast doubt on longstanding prohibitions on the possession of firearms by felons and the mentally ill, or laws forbidding the carrying of firearms in sensitive places such as schools and government buildings, or laws imposing conditions and qualifications on the commercial sale of arms.”¹¹ This language, coupled with the Court’s failure to articulate a clear standard for reviewing firearm regulations, has meant that most firearm laws have been upheld by lower courts.

Courts have generally used a two-part inquiry to evaluate firearm laws after *Heller*. Though *Heller* did not explicitly outline this inquiry, lower courts have mostly agreed that *Heller* provides support for this method of evaluating the constitutionality of firearm laws. First, the court examines whether the law at issue “burdens conduct protected by the Second Amendment.” If not, the Second Amendment analysis ends. If the law does burden conduct protected by the Second Amendment, the court proceeds to the second step of the inquiry—analyzing the law using “an appropriate level of scrutiny.”³¹

To determine whether a law burdens conduct protected by the Second Amendment, courts examine the “historical understanding of the scope” of the Amendment.¹¹ This often includes evaluating whether the law is “a presumptively lawful

longstanding prohibition.”³² The decision that a law falls within the category of presumptively lawful prohibitions may end the court’s analysis.³² Most courts, however, proceed to the second step—applying the appropriate level of scrutiny.^b

Generally, courts can apply one of three broad types of scrutiny when reviewing statutes—rational basis, intermediate scrutiny, or strict scrutiny.³³ Under rational basis, the most permissive standard, courts ask whether the statute is rationally related to a legitimate government interest. Under strict scrutiny, the most stringent standard, the statute is upheld only if it is narrowly tailored to serve a compelling government interest. Intermediate scrutiny lies between rational basis and strict scrutiny, requiring the court to engage in a lengthier analysis—determine whether the statute furthers a “significant, substantial, or important” government interest and whether there is a reasonable fit between the statute and the “asserted objective.”³⁴ The level of scrutiny courts apply to firearm regulations depends upon whether the regulation in question burdens the “core” of the Second Amendment—self-defense in the home.³⁵ If the regulation burdens this core, courts apply strict scrutiny. Otherwise, courts use intermediate scrutiny.

Although concealed carry laws have historically been upheld, in the post-*Heller* period there has been an uneven split. The Second,³⁶ Third,³⁷ Fourth,³⁸ Ninth,³⁹ and Tenth⁴⁰ Circuits have all upheld portions of concealed carry regulations, finding that they did not violate the Second Amendment. Most recently, however, the D.C. Circuit struck down the District of Columbia’s good cause requirement, holding that the District’s

^b The Seventh Circuit is the only Circuit to deviate from this second step, requiring courts to instead evaluate the importance of the government’s objective and whether there is a substantial relationship between the regulation and objective. *U.S. v. Skoien*, 614 F.3d 638 (7th Cir. 2010). It is unclear how this standard differs, in practice, from intermediate scrutiny.³³

scheme amounted to a total ban on a “core” right of the Second Amendment—carrying a concealed firearm.⁴¹

Aside from the D.C. Circuit’s decision, there is general consensus across the courts that have examined concealed carry laws in the post-*Heller* era that these laws do not violate the Second Amendment. In reaching this decision, courts have had to engage in the analysis described above. Concealed carry laws have been around for well over a century, and therefore are likely to be considered “presumptively lawful, longstanding prohibitions” that do not burden conduct protected by the Second Amendment. Relatedly, even if a court were to reach the opposite conclusion, that laws governing concealed carry burden conduct protected by the Second Amendment, that conduct is not at the *core* of the Second Amendment right articulated by the Supreme Court in *Heller*. Public concealed carry of firearms does not affect self-defense in the home. As such, intermediate scrutiny is the appropriate standard of review. If, however, the Supreme Court were to hear an applicable case and hold that public carrying of a concealed weapon is, in fact, at the core of the Second Amendment right, strict scrutiny would apply. Under strict scrutiny, a state government may have a difficult time defending its concealed carry regime. Although there is no doubt that the government has compelling interests in public safety and reducing crime, it is not clear that regulating concealed carry is *narrowly tailored* to address those compelling interests.

Under intermediate scrutiny, which is the standard of review courts have deemed applicable for non-core Second Amendment activities under *Heller*, concealed carry regulations are likely to be upheld. A court applying intermediate scrutiny will ask whether the statute furthers an important government interest and whether there is a

reasonable fit between that the challenged statute and that interest. The government interest in public safety is undoubtedly important. Ensuring that only law-abiding, trained citizens can carry concealed weapons in public is reasonably suited to further that interest. There is significant debate on this point, however. Some advocates argue that the presence of more firearms will deter crime. Others argue that the presence of more firearms in public will inevitably lead to more crime and violence. Though suicide accounts for the greatest number of firearm deaths, suicide risk is rarely discussed. Empirical research can help illuminate the relationship between crime, firearm-related deaths, and concealed carry laws.

CONCEALED CARRY AND PUBLIC HEALTH OUTCOMES

Concealed carry laws affect the availability of firearms and therefore have an inevitable effect on public health. In general, ready access to firearms increases the risk for all types of firearm-related injury and death. Because of resource and data shortages, there is a dearth of research examining the specific relationships between concealed carry and public health outcomes. Suicide, in particular, has not been explored and is seldom acknowledged in policy debates. The legal elements described above, coupled with prior empirical analyses, point to the potential incidental effects of concealed carry laws on interpersonal violence, suicide mortality, and suicide prevention.

Proponents of loosening state regulation of concealed carry assert that more people carrying guns will deter crime.^{42,43} Rigorous research has shown that this is not the case. In fact, relatively lax concealed carry laws are associated with increases in violent crime. Recent work has shown these increases to be cumulative—growing on a yearly basis for at least ten years following implementation.¹⁴ There are several possible

mechanisms for this relationship. Simply increasing the number of concealed guns carried in public may increase overall access to firearms. Alternatively, in states with relaxed concealed carry laws, guns are more likely to be present in situations where interpersonal conflict arises.

States that adopt permitless carry schemes are facilitating wide temporal and spatial access to firearms, but they are also complicating interactions between law enforcement and civilians. Concealed weapons are hidden from everyone, including law enforcement. In states requiring permits, permit holders stopped by law enforcement must disclose that they are carrying a concealed firearm and display a valid permit upon request.⁴⁴ In states allowing permitless carry, an individual carrying a concealed firearm may be required to tell police about the gun, but the legality of that individual's decision to carry is more difficult to determine. There is no permit for the officer to check. A permit allows an investigating officer to safely assume that the individual is not prohibited from carrying or possessing a firearm. Even where a permit is required and presented to an officer, the "presence of a gun" may lead the officer to act impulsively or violently, as in the case of Philando Castile.⁴⁵ The tension between permitless carry and police stops, searches, and seizures has not been adequately explored.

While there is research evidence to support the conclusion that weaker concealed carry regulations are associated with increases in violent crime, the relationship between concealed carry and suicide has not been adequately scrutinized. The theoretical link between the two—that permissive concealed carry laws facilitate access to firearms, thereby increasing risk of death by suicide—has not been rigorously tested. This is due, in part, to the absence of the best data. Most states keep concealed carry permitting data

confidential. A few states publish annual reports. Michigan has been issuing annual reports of concealed carry permitting activities, including crime and suicide outcomes, since 2004.^{46,47} These reports track the number of applications, permits issued, applications denied, permits revoked, and certain outcomes for a given period (usually 12 months). The reports also link Michigan Department of Health data with the state concealed pistol database to determine how many permit holders die by suicide each year. From 2003 to 2015, the number of suicide deaths among permit holders was relatively stable, ranging from a low of 16 deaths for the 2003–2004 report to a high of 70 deaths in 2013–2014.

In 2015, Michigan made two major changes to its concealed carry permitting scheme. First, it shifted from using a three-person concealed carry board to evaluate applications to using county clerks. Second, Michigan also removed a provision that allowed the concealed carry board to deny an application if it felt that the applicant was a danger to self or others.⁴⁸ The available data is insufficient to make a causal inference, but in the 2 years following those changes, the number of suicides among permit holders increased dramatically. The 2015–2016 report (October 2015 through September 2016) lists 84 deaths by suicide and the 2016–2017 report (October 2016–September 2017) lists 132 deaths by suicide. It is unclear whether those individuals who died by suicide were issued permits under Michigan’s new scheme or whether there were other factors contributing to this marked increase in suicide mortality among permit holders. The annual reports also do not make it clear how many valid permits are in circulation. Overall, Michigan experienced a 32.9% increase in suicide mortality between 1999 and 2016.⁴⁹ The permit holder-specific suicide data provided by the state suggests that there

may be a relationship between the stringency with which applications are reviewed and suicide risk.

IMPLICATIONS FOR STATE CONCEALED CARRY POLICY AND SUICIDE PREVENTION

States should be looking at the overall policy landscape, constitutional infrastructure, and public health evidence surrounding concealed carrying of firearms during the policymaking process. Though laws governing concealed carry are intended to affect a public health outcome—namely crime—there are important incidental effects, like suicide risk, that deserve more attention.

There are very few states that directly address suicide in their concealed carry statutes. Massachusetts requires the most direct mention of suicide. As of January 1, 2015, all Massachusetts firearm licenses must display both the National Suicide Prevention Lifeline and the Samaritans Statewide Helpline.⁵⁰ There are a few states, including Oklahoma,⁵¹ that prohibit anyone who has survived a suicide attempt from obtaining a permit.

Though most states do not mention suicide in their statutes, they may mention it during a required firearm training course. For example, the Arkansas State Police publishes syllabi for its training courses. Arkansas offers two types of license, a regular concealed carry license and an “enhanced” license that allows the license holder to carry a concealed firearm into otherwise prohibited locations like churches, bars, and university campuses.⁵² The training manual for the standard license does not mention suicide⁵³, but the manual for the enhanced class discusses suicide risk explicitly and provides suicide prevention resources.⁵⁴ Though the discussion of suicide in the enhanced training class is

an important step, the failure to include a discussion of suicide for standard applicants is inexplicable.

More states should adopt statutes that explicitly require education on suicide risk as a part of training courses, the distribution of suicide prevention resources to permit holders, and the annual reporting of suicides by permit holders. Concealed carry training is a rare opportunity for states to interact with gun owners in a non-criminal setting. Required training courses often cover conflict resolution, techniques for safely carrying a firearm, and laws governing interaction with law enforcement while carrying. An overview of suicide risk and applicable safety measures fits well with these other safety topics.

Under current Second Amendment jurisprudence, states have a lot of flexibility when regulating concealed firearms. The Supreme Court has yet to identify public carry as a core part of the individual right protected by the Second Amendment and concealed carry regulations will likely continue, in general, to survive the post-*Heller* test adopted by lower courts. States should feel confident then, rigorously regulating concealed carry. This study has shown, however, that most states are deregulating concealed carry. The shift toward shall issue and permitless laws is the result of carefully crafted political rhetoric—of a sociopolitical version of the Second Amendment that protects a more expansive set of rights. From a public health perspective, states should resist the shift toward permitless carry. States that allow permitless concealed carry have abandoned a key point of interaction between gun owners and the state. Though deregulation is associated with increased violent crime, and perhaps increased suicide risk, the

permitting process provides an opportunity for the government to address these public health concerns directly, in collaboration with gun owners.

Despite the violent crime associated with shall issue laws, reverting to may issue laws is politically infeasible. There are other reasons, however, to favor revision of shall issue laws over a return to may issue laws. May issue laws grant wide discretion to the state in determining who may acquire a concealed carry permit. In many cases, when this discretion is exercised to deny a permit application, adverse public health outcomes are avoided. In some cases, however, law enforcement discretion can be used in a discriminatory fashion, thereby disadvantaging certain races or classes. Though permitholder data is mostly confidential, the potential for discriminatory permitting decisions warrants further analysis.

CONCLUSION

Though more empirical research is needed to understand the full relationship between concealed carry and public health, there is no doubt that firearms are often used to violently and irrevocably resolve transient problems. Concealed carry laws that expand access to firearms are detrimental to public health. Deregulation of concealed carry is associated with violent crime and may increase the risk of death by suicide by expanding access to firearms. States should resist the shift toward permitless carry, focusing instead on developing objective standards for issuing permits and fortifying the permitting process with training requirements that emphasize safe storage, safe use, conflict de-escalation, and suicide prevention.

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**CONCEALED CARRY POLICY AND SUICIDE: EXAMINING THE
RELATIONSHIP BETWEEN BROAD CATEGORIZATIONS OF STATE LAW
AND SUICIDE MORTALITY**

ABSTRACT

Objective: To determine whether shall issue and permitless laws, which make it easier to carry a concealed firearm, are associated with suicide mortality.

Methods: Suicide mortality counts from 1980–2015 were collected from the National Center for Health Statistics and 50-state legal data was compiled using Westlaw and HeinOnline. Laws were coded according to the ease with which an individual can publicly carry a concealed firearm. The primary independent variables were shall issue laws and permitless laws. The statistical analysis consisted of negative binomial models with state fixed effects and synthetic control methods.

Results: The analysis found no statistically significant relationship between shall issue laws and suicide mortality. Laws allowing permitless carry had a harmful effect on firearm suicide that was present in both the regression results and the synthetic control results, however, the external validity of this result is limited by the small number of states with permitless laws during the study period.

Conclusions: Though shall issue laws are not broadly associated with suicide mortality, states allowing permitless carry may see increases in suicide. This relationship warrants further analysis.

INTRODUCTION

Suicide is the 10th-leading cause of death in the United States. In general, the suicide rate has increased over the last 16 years. The overall suicide mortality rate is

higher in men than in women, though 2016 mortality rates were higher than 2000 rates across all age groups under 75 for both men and women.¹ There are many risk factors for suicide, including family history, previous suicide attempts, and history of mental disorders, however access to lethal means is a key point for both programmatic and policy interventions.² Firearms, in particular, are intimately related to suicide.

About 60% of firearm deaths are suicides and firearms are used in approximately half of deaths by suicide.³ Firearms are used in the majority of male deaths by suicide. For female deaths by suicide, 2016 firearm use trails suffocation for ages 15–24 and poisoning for ages 45 and up, but is the most prevalent means for females ages 25–44.¹ Research has shown that, after controlling for other risk factors, suicide deaths are more likely to occur in homes with firearms than in homes without firearms.^{4,5} Overall, states with higher rates of firearm ownership have higher rates of both firearm-specific suicide deaths and overall suicide deaths.⁶ These findings suggest that exposure to firearms enhances the risk of death by suicide.

One mechanism by which firearm exposure enhances the risk of death by suicide is firearm lethality. Compared to other means of intentional self-harm—including poisoning, suffocation, falls, and cutting or piercing—firearms have the highest case fatality rate. Multiple studies have placed the case fatality rate close to 90%, while the rate for suffocation—the next highest rate among the most common lethal means—is around 70%.^{7,8,9} The differences in means-specific lethality are important because they are stable across demographic groups. What varies across groups is the prevalence of a given lethal method. For example, females are more likely to attempt suicide, but males are much more likely to die by suicide. This is largely due to differences in

methodology—men are more likely to use highly lethal means, including firearms, than are women.^{8,9,10}

Despite the many varying risk factors for death by suicide, the lethality of firearms plays an outsized role in the mortality rate. Suicide research has consistently found that approximately 90% of individuals who survive a suicide attempt will not ultimately die by suicide.¹¹ Individuals are more likely to survive a suicide attempt—often an impulsive act¹²— if the lethality of the available means of self-harm is low. Thus, not only are firearms immediately more lethal, but, those who opt for other means of self-harm are less likely to ever die by suicide than those who use firearms.

Because firearm availability is so intimately tied to death by suicide, firearm laws may affect suicide rates. Any potential association between firearm laws and suicide is of particular relevance for states, across which firearm laws vary in important ways. State laws regulating the sale and possession of firearms can be effective at reducing suicide mortality. Permit-to-Purchase laws, which require a prospective firearm purchaser to undergo a criminal background check and acquire a license prior to obtaining a firearm, are associated with decreased homicide and suicide.^{13,14}

Laws governing the concealed carry of firearms are similar to those governing permits to purchase, but instead of regulating who can acquire firearms, they regulate who can carry a concealed firearm in public. Each state has its own law governing the concealed carry of firearms. While no state bans concealed carry entirely, there are a variety of regulatory schemes. The states can be sorted into 3 broad categories: may issue, shall issue, and no permit required (permitless). The category names refer to the ease with which the permits allowing individuals to carry a concealed weapon are issued.

Historically, there have been states that fall into a fourth category—no issue—but no state currently has such a strict law. In states with shall issue and may issue laws, a permit is required to carry a concealed firearm. Under permitless laws, a permit is not required. The key difference between shall-issue and may-issue laws is the discretion afforded the state in issuing a permit to an applicant. Under shall issue laws, if an applicant meets the statutory criteria, the state must issue a permit. Under may issue laws, even if an applicant meets the statutory criteria, the state still has the discretion to deny the application. Because it is relatively easy to obtain a permit (if required) and to carry a concealed weapon under shall-issue and permitless laws, these laws are often called “Right-to-Carry” (RTC) laws.

Most of the research on concealed carry laws has focused on crime. Politically, concealed carry permits are highly contentious. “RTC laws” are at the center of the “more guns, less crime” hypothesis.¹⁵ The most robust research, however, has found that the studies supporting this hypothesis are faulty and, in fact, that shall-issue laws may have the opposite effect. Researchers have found that RTC laws are associated with higher rates of violent and property crime.^{16,17} The mechanism for this increase is somewhat unclear. It is not necessarily the case that concealed carry permit holders are responsible for increases in crime. However, the mere presence of firearms in otherwise contentious or dangerous scenarios may increase the risk for violence. The key mechanisms have not yet been determined in part because permit information is confidential in most states.¹⁸

The relationship between concealed carry schemes and suicide rates has not been adequately studied. If the risk of death by suicide is elevated by exposure to firearms,

laws that facilitate the public carrying of firearms may increase that risk. Concealed carry permitting schemes may also affect suicide risk because permit holders are exempt from certain background check requirements. Lastly, even if there is no direct relationship between concealed carry permits and suicide risk, shall-issue laws may contribute to a normative environment that discourages lethal means restrictions and counseling. Even if the effect of concealed carry permitting on suicide is minimal, however, analysis of the relationship fills an important research gap. A fuller understanding of the relationship between firearms and suicide will help researchers and policymakers craft evidence-based suicide-prevention strategies.

The purpose of this research is to evaluate the hypothesis that states with laws facilitating the carrying of concealed weapons see greater suicide mortality. This research helps to deepen our understanding of the relationship between firearms and suicide and serves to clarify the mechanism underlying the relationship between concealed carry and violent crime.

METHODS

Data Collection

This research relied on suicide mortality data obtained from the National Center for Health Statistics.¹⁹ Demographic covariates were obtained from the United States Census,²⁰ the Bureau of Labor Statistics (1980–2016),²¹ the Religion and Congregation Membership Survey,²² and the National Institute on Alcohol Abuse and Alcoholism,²³ and interpolated for intercensal years.

The legal data was compiled using traditional public health law research methods. Each state's concealed carry law was retrieved from the Thomson Reuters Westlaw

database. Each statute relevant to concealed carry was pulled from a state code using a series of standard search terms.^c In some states—particularly those allowing permitless carry—the relevant policy was articulated in the state statute criminalizing certain types of public carrying. The legislative history and implementation dates of each law, dating back to 1980, were tracked using Westlaw and HeinOnline. Each state’s policy was coded for its overarching policy. Mental health parity laws, permit-to-purchase laws, point of sale background check laws, and waiting period laws were also collected. These laws and implementation dates were compared to existing databases and prior research to check accuracy. A state was coded as having a certain law or policy if that policy had been in effect for at least 6 months of a given year. The analyses were run, however, with the law variables lagged one year to account for the time necessary to implement a new law.

The dependent variables were yearly state suicide mortality counts, obtained from the National Center for Health Statistics.¹⁹ The individual mortality data was coded to create 5 different aggregate counts: All state suicide mortality, all state suicide mortality without overdoses, state firearm suicide mortality, state nonfirearm suicide mortality, and state nonfirearm suicide mortality without overdoses. These counts were also broken into 4 demographic categories: all ages, decedents coded as 20 years of age or older (“adult”), all decedents coded as male, and all decedents coded as female. The time period for all regression analyses was 1980–2015.

Statistical Methods

^c These search terms included “conceal*”, “gun or firearm”, “carry”, “permit or license”, and others.

The statistical analysis was conducted in two parts: (1) A 50-state comparative interrupted time series analysis, and (2) an analysis of specific state law changes using synthetic control methods. Both methods used the same independent variables: Indicator variables for shall issue laws and permitless laws.

The 50-state comparative interrupted time series analysis consisted of generalized linear models with a negative binomial distribution to account for over-dispersion in suicide mortality counts and robust standard errors to account for clustering by state. The exposure variable for each model was the total population at risk of joining the specific dependent variable suicide count (e.g., for a model analyzing state counts of overall suicide mortality, the exposure variable was the total state population. For a model analyzing the state counts of overall suicide mortality in individuals 20 and over, the exposure variable was total state population aged 20 and over). Each model also accounted for state-level fixed effects and included quadratic year trend terms.

The selection of covariates was based on prior research and theory showing an association with suicide mortality. The negative binomial regression models all used the same set of demographic covariates: state unemployment rate, state poverty rate, percent of the state population identified as male, percent of the state population identified as veteran, percent of the state population identified as black, percent of the state population that is married, percent of the state population living in a metro statistical area, state ethanol consumption per capita (age 14 and up), state rate of religious adherence, the percent of state population that has graduated from high school, and the percent of each state identified as Republican. Percent Republican was included to adjust for the increased likelihood that majority-Republican states would deregulate concealed carry

and the likely correlation between political views and firearm ownership. Each model also accounted for the addict overdose rate by subtracting overdoses coded as deaths by suicide from the overall number of overdose deaths. This variable was included to help control for trends in the use of opioids. The models also used the same set of legal covariates: permit to purchase laws, point of sale background check laws, waiting period laws, and mental health parity laws.

In addition, to evaluate the cumulative effect of the shall issue and permitless laws, a series of regression analyses used an independent variable that accounted for a gradual increase in the effect of the law. The gradual variables for shall issue and permitless were coded as 1 for the first full year they were implemented. The variable increased by 1 for each successive year, but the variable was capped at 10. Prior research has suggested that RTC laws have an increasing effect over 10 years.¹⁶ For these analyses, states that had shall issue or permitless laws for more than 10 years prior to 1980—states for which the gradual effect variables would have been coded 10 throughout the study period—were excluded. This was only 4 states: New Hampshire, Rhode Island, Vermont, and Washington.

The regression models were supplemented with synthetic control models. Synthetic control modeling is an innovative statistical technique that provides a more accurate counterfactual estimate. For each state “treated” by a new law, a synthetic control state is constructed from a convex combination of weighted donor states. These donor states are selected from a pool of states “at risk” of enacting the same law—states that do not have the law and do not enact it for at least 10 years following the treated state. The donor states are weighted to construct a synthetic control that approximates the

treated state on the chosen outcome variable and selected demographic predictors in the pre-law period (usually 10 years). The behavior of the synthetic control in the post-law period (also usually 10 years) is then compared to the behavior of the actual treated state.²⁴

Additional tests are required to enable researchers to make inferences about the comparison between the synthetic state and the treated state. These “placebo” tests iteratively run the same synthetic control process using donor states as the treated state. This process seeks to determine whether the observed treatment effect of interest is, in fact, rare among all included states. The placebo test generates a proportion of donor states with results more extreme than the state of interest. This proportion is akin to a more traditional p-value.²⁴

A synthetic control model was constructed for each state that enacted a shall issue or permitless law during the study period. For each treated state, the donor pool included states that did not have the relevant law for the pre- or post-law period. The outcome for the synthetic control models was a moving average of the state adult male firearm suicide mortality rate. This outcome was selected because of the consistent relationship identified in the regression analyses. A 3-year moving average was chosen to smooth the otherwise volatile outcome trend and improve the pre-law fit of the synthetic control. All of the covariates used in the regression analyses were used as predictors in the synthetic control models, except percent republican, which the model excluded as a result of its relative invariance, and the legal covariates, which were not eligible for inclusion because they were dichotomous. The outcome for every other pre-law year was also included as a predictor.

RESULTS

In 1980, there were 21 states with no issue laws, 24 states with no issue laws, 4 states with shall issue laws, and 1 state that allowed permitless carry. By 2015, there were 0 states with no issue laws, 8 states with may issue laws, 38 states with shall issue laws, and 4 states with permitless laws (Table 1).^d In general, the overall mean suicide rate and overall mean firearm suicide rate are higher in states with shall issue and permitless laws, particularly after 1990 (Fig 1). This is also true of suicide deaths among individuals 20 or older (“adults”) (Fig 2). Firearm suicide was far more common among males (87.5%) than females (12.5%). Again, these distributions were similar among the adult population (Table 3).

Comparative Interrupted Time Series Results

In general, shall issue laws were not associated with changes in suicide mortality. Shall issue laws were, however, associated with increases in all-ages nonfirearm suicide deaths (IRR = 1.045, 95% CI: 1.01, 1.08). This association was not present in models omitting overdoses from the suicide mortality counts. Because no theoretical mechanism explains a relationship between concealed carry laws and overdose suicides, these results may suggest potential issues with overdose suicide data. For this reason, results presented here are limited to models that excluded overdose deaths (Tables 4A–4F).

Consistently, across dependent variables, states allowing permitless carry saw increased suicide mortality. Permitless laws were associated with a statistically significant 20.0% increase in firearm suicide deaths (All ages: IRR = 1.20, 95 % CI: 1.06, 1.36; Adults: IRR = 1.20, 95% CI: 1.04, 1.39). For all ages, permitless laws were also

^d The number of permitless states would increase to 12 by the end of 2017.

associated with a smaller increase in overall suicide mortality (IRR = 1.11, 95% CI: 1.01, 1.22) and nonfirearm suicide mortality (IRR = 1.12, 95% CI: 1.06, 1.19). In the adult population, permitless laws were associated with a 12% increase in nonfirearm suicide (IRR = 1.12, 95% CI: 1.04, 1.21), but the corresponding increase in overall suicide mortality was not statistically significant (Tables 4A, 4D).

The relationship between permitless laws and male firearm suicide was similar. Laws allowing permitless carry were associated with a 19.4% increase in male firearm suicide mortality (IRR = 1.19, 95% CI: 1.06, 1.35) (Table 4C). The increase among adult males was slightly greater (IRR = 1.24, 95 % CI: 1.05, 1.46) (Table 4F). Females in both groups saw larger relative increases than males in states with permitless laws (all ages: IRR = 1.23, 95% CI: 1.06, 1.43; adults: IRR = 1.28, 95% CI: 1.06, 1.56) (Tables 4B, 4E).

The results of the model with gradual effect independent variables do not indicate that the effect of shall issue laws increased or changed over time, but there is some suggestion that permitless laws were associated with a cumulative harmful effect on suicide mortality. Across both gender and age groups, permitless laws were associated with a small yearly increase in overall suicide mortality, firearm suicide mortality, and, to a lesser extent, nonfirearm suicide mortality (Tables 5A–5F). However, because permitless laws are relatively rare in the dataset, the external validity of these results is limited. For example, Alaska is the only state for which the gradual effect permitless law variable is ever greater than 5.

Synthetic Control Results

The synthetic control results presented here are limited to firearm suicide deaths in adult males. The average mean squared prediction error (“MSPE”, the statistic used to

evaluate the pre-law fit of the synthetic control) was 20.52, however this was driven by several states with MSPE values greater than 30, including 2 greater than 150. Most of the MSPE values were small. Of the 34 models, 18 had MSPE values less than 2 and 13 had MSPE values less than 1. States with an MSPE value less than 1 were considered to have the best fit. There is no standard for determining which synthetic control models are acceptable because each analysis is unique. Analyses like these are somewhat sensitive because of the volatility of the outcome and the relatively small number of states eligible for each donor pool. An MSPE of 1 was chosen as the cutoff point for a model with the best fit in an attempt to protect against these weaknesses. Choosing this MSPE ensured that any inferences drawn from the aggregate analysis would be conservative.

In general, among states with the best pre-law fit (MSPE<1) the average effect of a shall issue law was modest: a 1.03% increase in male firearm suicides in the adult population. The range of results was quite large, however—Texas saw a 23.0% *decrease* in male suicide mortality and Minnesota saw a 21.7% increase. Of the 13 states with an MSPE<1, eight saw an increase in suicide mortality following implementation of a shall issue law and 5 saw a decrease in suicide mortality (Table 6A). Synthetic control analyses do not generate a traditional measure of statistical significance, but the placebo test results can provide an approximation of significance. Seven states had placebo results less than 0.1—where the proportion of the placebo states with more extreme changes among placebo states with a good pre-law fit was less than 0.1: Georgia, Michigan, Minnesota, Oregon, Texas, Virginia, and West Virginia. Of these, Michigan (7.0%), Minnesota (21.7%), Oregon (9.7%), and West Virginia (10.7%) saw increases in male firearm suicide mortality following implementation of a shall issue law. Georgia (−4.8%),

Texas (−23.0%), and Virginia (−12.3%) all saw decreases in male firearm suicide mortality. (Fig 3). Some of these states saw a divergence prior to implementation of the law, which may suggest that the actual effect is smaller or that the observed effect is due to some unobserved factor (Synthetic Control Graphs Appendix).

Among permitless states, the results are limited (Table 6B). Only 2 states—Alaska and Arizona—were eligible for a synthetic control analysis. Alaska’s pre-law fit was mediocre (MSPE = 3.44), while Arizona’s was quite good (0.09). Both states saw an increase in male firearm suicide following the switch to a permitless scheme—13.24% in Alaska and 1.02% in Arizona—but only Alaska’s placebo results suggested statistical significance. Despite these placebo results, Alaska’s questionable fit and Arizona’s short post-law period (5 years instead of the more-typical 10 years) suggest that these results are, at most, merely suggestive of a harmful effect.

DISCUSSION

States have increasingly deregulated concealed weapons. Over the study period, from 1980 to 2015, shall issue laws became more popular and some states even drifted further, passing bills that enabled permitless concealed carry. Though prior work has shown that shall issue and permitless laws—RTC laws—are associated with elevated rates of violent crime, the present study suggests that these laws do not have a similar effect on suicide mortality.

Taken together, the comparative interrupted time series and synthetic control results suggest no consistently harmful or protective effect of shall issue laws. The interrupted time series analyses show no significant effect of shall issue laws, especially once overdoses are removed from the suicide count. The synthetic control analyses

resulted in an array of shall-issue effects, but the distribution of those effects suggests that the changes in suicide mortality rates may be the result of some legal or demographic variable that was not included in the synthetic control analysis. The overarching concealed carry policy does not help explain why some states would have seen increases and others would see decreases.

Permitless carry appears, from these analyses, to be associated with increases in suicide mortality. These results should be treated with caution. Though 12 states now allow permitless carry, only 4 states allowed permitless carry at the end of the study period. One, Vermont, allowed permitless carry throughout the study period. Of the others, only Alaska (2003) implemented its permitless carry scheme prior to 2010. The regression results are therefore based on a small sample. Of those 4 states, only Alaska and Arizona were eligible for synthetic control analyses, and the Arizona analysis had a truncated post-law period. Alaska's results showed a statistically significant 13.24% increase in male firearm suicides, but the pre-law fit was somewhat weak. Despite these caveats, there is reason to suspect that states allowing permitless carry are seeing increases in suicide mortality. As more yearly data becomes available for states with permitless laws, these analyses should be performed again.

This study has a few weaknesses. The number of states with permitless laws was limited by data availability. At the time the study was initiated, data was only available through 2015, meaning that only 4 permitless laws were in effect by the end of the study period. Also, all legal variables were lagged by one year in the regression models to account for implementation delays, but permitless laws may take effect much more quickly because the permit requirement is simply repealed. Very little is known about the

implementation of permitting laws, so all laws were treated similarly in these analyses. Nonetheless, it is possible that each type of law is implemented at different speeds. Relatedly, permitholder data is very difficult to obtain. Most states keep permitholder data confidential and even those that provide some public data only generate aggregate counts. As a result, it is very difficult to determine whether legal changes actually change permitting and carrying behavior.

Visual analysis of the synthetic control graphs also reveals that, for some states saw a post-law change, the divergence of the treated state from the synthetic state occurred prior to the treatment year. This could indicate that the observed effect is the result of some other factor. Alternatively, it could mean that, in advance of the new law, behavior and enforcement changed. A more detailed analysis of specific states is necessary to investigate these potential weaknesses.

Despite these weaknesses, this analysis has several strengths. It is the first study to rigorously evaluate the relationship between concealed carry and suicide. The statistical methods employed to examine this relationship were robust and modeled after prior successful evaluations of concealed carry laws. In addition, the legal research informing this study can be used for future public health law research studies of public firearm carrying.

These findings point to the need for future analyses of concealed carry. Researchers should dig deeper into specific state concealed carry permitting requirements to see if the elements underlying the overarching regulatory scheme have an effect on suicide and violent crime. In addition, future research should explore whether the effects

of concealed carry laws differ across races. This is particularly important when laws include elements of law enforcement discretion.

PUBLIC HEALTH IMPLICATIONS

RTC laws have a proven harmful effect on public health. States that have deregulated concealed carry have seen increases in violent crime.¹⁶ The relationship between concealed carry and suicide is more complex. The present analysis suggests that the association, if any, between concealed carry and suicide is limited to the harmful effect of permitless carry. More research is needed to determine the size and significance of that effect. The overall results, however, help clarify the relationship between concealed carry and violent crime.

Increased access to firearms increases the risk of death by suicide. If shall issue laws were causing increases in the overall number of firearms, states adopting those laws would expect to see increases in suicide mortality. This research fails to find such an association, implying that shall issue laws increase the likelihood that a firearm will be present in situations likely to give rise to interpersonal conflict, but do not increase overall access to firearms. To truly understand the relationship between concealed carry and firearm-related crime and mortality, however, additional analyses of specific permitting requirements are essential. It is possible that specific elements of concealed carry permitting laws have harmful or protective effects.

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UNDERLYING CONCEALED CARRY PERMITTING REQUIREMENTS AND SUICIDE: IDENTIFYING POTENTIAL POINTS OF INTERVENTION

ABSTRACT

Objective: To determine whether specific elements of concealed carry permitting laws, including training, good cause, and suitability requirements, are associated with suicide mortality.

Methods: Suicide mortality counts from 1980–2015 were collected from the National Center for Health Statistics and 50-state legal data was compiled using Westlaw and HeinOnline. The primary independent variables were laws requiring training, a good cause for obtaining a permit, and applicant suitability. The statistical analysis consisted of negative binomial models with state fixed effects and synthetic control methods.

Results: States requiring training as part of the permitting process saw decreased suicide mortality. This effect may, however, be limited to states with the most restrictive concealed carry permitting policies. Good cause and suitability requirements had no consistent relationship with suicide.

Conclusion: Training courses may help prevent deaths by suicide. Even if the effect is limited to states with certain legal infrastructures, these courses represent a promising point of intervention for suicide prevention efforts.

INTRODUCTION

Deaths by suicide are the most common type of firearm-related mortality. Often, there is a disconnect between this epidemiology and policy interventions intended to reduce gun violence. Most firearm laws—either loosening or tightening regulation of firearms—are intended to combat interpersonal violence and crime. It is no surprise, then,

that most firearm law research seeks to evaluate whether these laws fulfill that function. A key tenet of public health law research, however, is that laws have incidental effects.¹ Because firearms and suicide are intimately linked, any firearm law will affect suicide risk even if suicide risk was not considered prior to implementation. For each analysis of the effect of firearm laws on interpersonal violence and crime, there should be a corresponding analysis of the effect of those same laws on suicide mortality. This research seeks to build on prior analyses of the incidental effects of firearm laws on suicide by exploring the detailed requirements of concealed carry laws: training, good cause, and suitability.

Firearms and suicide are intimately linked. Approximately 60% of firearm deaths are suicides and firearms are implicated in about 50% of suicide deaths.² After controlling for other factors, researchers found that suicide deaths are more likely to occur in homes with firearms.^{3,4} This relationship between access and suicide risk extends to the state level—states with higher rates of firearm ownership have higher rates of both firearm-specific and overall suicide.⁵ These findings suggest that exposure to firearms elevates the risk of death by suicide.

Firearm laws undoubtedly regulate exposure to firearms. Laws governing firearm transfers, for example, can limit exposure for high-risk individuals prohibited from possessing a gun. Prior research has shown that permit-to-purchase (“PTP”) laws, which require a prospective firearm purchaser to undergo a background check and acquire a permit prior to obtaining a firearm, are associated with lower rates of homicide, suicide, and diversion of guns to criminal markets.^{6,7} Once a person has legally obtained a firearm, however, other laws dictate where and how they may carry a firearm in public.

Laws governing the concealed carry of firearms in public are associated with violent crime—states that make it easier to carry a concealed weapon see more interpersonal violence.^{8,9} Any relationship between concealed carry and suicide is less clear.

Instead of regulating who can acquire firearms, concealed carry laws regulate who can carry a hidden firearm in public. Every state allows concealed carry, but there are important differences between state regulatory schemes. There are 3 broad categories of concealed carry law: may issue, shall issue, and permitless. May and shall issue states require permits, but differ in the discretion afforded the state in making individual application decisions. Under shall issue laws (30 states), the state has little-to-no discretion—if an applicant meets the statutory criteria the state must issue a permit. Under may issue laws (8 states), even if an applicant meets the statutory criteria the state has discretion to deny the application if the applicant appears to be an unsuitable candidate in some way. The remaining 12 states are permitless states. In these states, individuals who legally own firearms can carry a concealed gun without a permit.

This last category, which essentially allows unfettered concealed carry, is the only one of these policies that is associated with suicide risk. Manuscript 2 suggests that these states see higher rates of firearm suicide,¹⁰ but these laws have only become popular recently which means that the sample size underlying these findings is relatively small. The fact that these categories are not strongly associated with suicide mortality but are associated with violent crime indicates that the practical effect of these broad policy categories (may issue, shall issue, and permitless) is contextual. A law that makes it easier to carry a concealed weapon may increase the likelihood that a firearm is

accessible during an interpersonal conflict, but may not have an effect on the availability of firearms in a situation preceding a suicidal act.

That these broad legal categories do not have a strong relationship with suicide is, perhaps, not surprising. Because researchers do not have access to detailed permitting statistics, it is difficult to determine the practical effect of the “discretion” afforded in may issue states. It is possible that the variations underlying each of the broad permitting schemes has a greater effect on suicide than the discretion afforded the state. There are several requirements for obtaining a permit that are often present in both may-issue and shall-issue states.

In the 38 states requiring a permit, the statutory criteria vary in important ways. Eleven states require the applicant to state a reason or good cause for acquiring a permit and carrying a concealed weapon (e.g., dangerous job or legitimate safety concern). Thirteen states determine whether the applicant is a “suitable” person before issuing a permit. “Suitable” may be defined explicitly, or it may be left to the issuing body to define. Thirty-one states require an applicant to demonstrate competence with a firearm—most often through a training course—prior to applying for a permit. Acceptable training courses can vary considerably, ranging from online courses to in-person intensives that must cover specific topics. Eighteen states require an applicant to actually fire a gun as part of training. Each of these specific requirements is present in multiple states with may-issue and shall-issue laws.

These specific requirements—training, good cause, and suitability—could affect suicide risk. The good cause and suitability requirements may help ensure that individuals at the highest risk of harming themselves or others are not able to secure a

permit and are therefore less likely to be exposed to firearms. The training requirement may help educate firearm owners about safe storage, safe use, and relevant transfer laws. Together, the burden of complying with these requirements may dissuade potential applicants from seeking a permit in the first place.

The purpose of this research is to evaluate two hypotheses: (1) States with training, suitability, or good cause requirements see lower suicide rates; (2) The effect of these requirements is modified by the presence of discretion in the overarching permitting scheme. This research helps to deepen our understanding of the relationship between firearms and suicide and may help identify opportunities for preventive interventions and collaborations to prevent deaths by suicide.

METHODS

Data Collection

This research relied on suicide mortality data obtained from the National Center for Health Statistics.¹¹ Demographic covariates were obtained from the United States Census,¹² the Bureau of Labor Statistics (1980–2016),¹³ the Religion and Congregation Membership Survey,¹⁴ and the National Institute on Alcohol Abuse and Alcoholism¹⁵ and interpolated for intercensal years.

The legal data was compiled using traditional public health law research methods. Each state's concealed carry law was retrieved from the Thomson Reuters Westlaw database. Each statute relevant to concealed carry was obtained from each state code. The legislative history and implementation dates of each overall concealed carry law and each of the specific requirements of interest (training, suitability, good cause) was tracked using Westlaw and HeinOnline. The legal coding matched the coding used in Manuscript

2. Mental health parity laws, permit-to-purchase laws, point of sale background check laws, and waiting period laws were also collected. A state was coded as having a certain law or policy if that policy had been in effect for at least 6 months of a given year. The analyses were run, however, with the law variables lagged one year to account for the time necessary to implement a new law.

As in Manuscript 2, the dependent variables were yearly state suicide mortality counts, obtained from the National Center for Health Statistics.¹¹ The individual mortality data was coded to create 5 different aggregate counts: All state suicide mortality, all state suicide mortality without overdoses, state firearm suicide mortality, state nonfirearm suicide mortality, state nonfirearm suicide mortality without overdoses. These counts were also broken into 4 demographic categories: all ages, decedents coded as over 20 years old (“adults”), decedents coded as male, and decedents coded as female.

Statistical Methods

The statistical analysis was conducted in two parts similar to those in Manuscript 2: (1) A 50-state comparative interrupted time series analysis, and (2) an analysis of specific state law changes using synthetic control methods. Both methods used the same independent variables: Indicator variables for overall concealed carry policy, a training requirement, a suitability requirement, and a good cause requirement.

The structure of the regression analyses was identical to Manuscript 2. The 50-state comparative interrupted time series analysis involved generalized linear models with a negative binomial distribution to account for over-dispersion in suicide mortality counts and robust standard errors to account for clustering by state. The exposure variable for each model was the total population at risk of joining the specific dependent variable

suicide count (e.g., for a model analyzing state counts of overall suicide mortality, the exposure variable was total population. For a model analyzing the state counts of overall suicide mortality in individuals 20 and over, the exposure variable was total population aged 20 and over). Each model also accounted for state-level fixed effects and included quadratic year trend terms.

The selection of covariates was based on prior research and theory showing an association with suicide mortality. The models all used the same set of demographic covariates: state unemployment rate, state poverty rate, percent of the state population identified as male, percent of the state population identified as veteran, percent of the state population identified as black, percent of the state population that is married, percent of the state population living in a metro statistical area, state ethanol consumption per capita (age 14 and up), state rate of religious adherence, the percent of state population that has graduated from high school, and the percent of the state population that identified as Republican. This last covariate was included to adjust for the increased likelihood that states controlled by Republican policy makers would deregulate concealed carry and for the theoretical relationship between political beliefs and firearm ownership. Each model also accounted for the addict overdose rate by subtracting overdoses coded as deaths by suicide from the overall number of overdose deaths. This variable was included to help control for trends in the use of opioids. The models also used the same set of legal covariates: permit to purchase laws, point of sale background check laws, waiting period laws, and mental health parity laws. Each of these covariates was identical to those used in Manuscript 2.

This analysis included a series of models. First, the individual requirements—training, suitability, and good cause—were analyzed without controlling for the overall concealed carry permitting scheme. Second, the individual requirements and the overall permitting scheme were included in the model. Third, the training requirement variable was interacted with the shall issue variable to determine whether the effect of training was modified by the overall concealed carry permitting policy.

The regression models were supplemented with synthetic control models. Synthetic control modeling is an innovative statistical technique that provides a more accurate counterfactual estimate. For an in-depth description of the Synthetic Control method, see Manuscript 2.¹⁶

A synthetic control model was constructed for each state that enacted a training requirement for concealed carry permitting during the study period. For each treated state, the donor pool included states that did not have a training requirement for the pre- or post-law period. As in Manuscript 2, the outcome for the synthetic control models was a moving average of the state adult male firearm suicide mortality rate, chosen because of the relationship identified in the negative binomial regression models. A 3-year moving average was chosen to smooth the outcome and improve the pre-law fit of the synthetic control. All of the covariates used in the regression analyses were used as predictors in the synthetic control models, except percent republican, which the model excluded as a result of its relative invariance, and the legal covariates, for the reasons explained in Manuscript 2. The outcome for every other pre-law year was also included as a predictor.

RESULTS

The distribution of suicide mortality across year and state was identical to Manuscript 2, but the distribution of specific permitting requirements underwent several large changes. In 1980, only 3 states had training requirements. By 2000, that number had increased to 26 and by 2015, the end of the study period, 36 states had some type of training requirement. 29 of the 38 states with shall issue laws and 7 of the 8 states with may issue laws required training in 2015.

Twenty-one states had a suitability requirement in 1980. Most of these were states that had may issue laws, but 3 of the 4 states with shall issue laws in 1980 had a suitability requirement. The total number of states requiring applicants to be “suitable” for permitting remained mostly stable throughout the study period, decreasing to 15 by 2015. Because the number of shall issue laws increased so dramatically during the study period, however, the percentage of states with both a suitability requirement and shall issue law decreased. In 2015, most (75.0%) of may issue laws included a suitability requirement, compared to just 23.7% of shall issue laws.

In 1980, there were 18 states with a good cause requirement. 3 of the 4 shall issue states had a good cause requirement, as did 15 of the 24 may issue states. By 2015, the number of states with good cause requirement had dwindled to 12. Most may issue states (75%) had good cause requirements in 2015, but, again because of the popularity of concealed carry deregulation, just 6 (15.8%) of the shall issue states had such a requirement.

In 1980, only 2 states, New Jersey and West Virginia, had all three of these requirements. That number only increased slightly, to 5, by 2015. West Virginia dropped

out of the group, leaving California, Delaware, Hawaii, Massachusetts, and New Jersey. Each of these states had a may issue law for the entire study period.

Comparative Interrupted Time Series Results

For the reasons explained in Manuscript 2—in short, that overdose suicides may not be counted correctly—the results presented here are those that exclude overdose suicides from the counts of overall and nonfirearm suicides.

In the models that excluded the shall issue and permitless variables, the presence of a training requirement was protective for all suicide (IRR = 0.97, 95% CI: 0.95, 0.99) and firearm suicide (IRR = 0.96, 95% CI: 0.93, 0.99) (Table 7A). The results for all male suicide and male firearm suicide were almost identical to these results (Table 7C).

Among females, training was protective (IRR = 0.96, 95% CI: 0.92, 0.99) for all suicide, but the results for firearm suicide were not statistically significant (Table 7B). Each of these results was the same for the adult population (aged 20 and over) except that training was also protective for nonfirearm female suicides (IRR = 0.95, 95 % CI: 0.91, 1.00) (Tables 7D–7F). Suitability requirements were only statistically significant in nonfirearm female suicides (all ages: IRR = 0.83, 95% CI: 0.72, 0.95; adults: IRR = 0.85, 95% CI: 0.76, 0.96) (Tables 7B, 7E). No relationship between good cause requirements and suicide was statistically significant in these models.

In the models that included the shall issue and permitless variables, the results were largely the same. As in Manuscript 2, permitless laws were associated with increased suicide mortality. The relationship between shall issue laws and suicide is generally not statistically significant, though in both age groups there was an increase in female nonfirearm suicide associated with shall issue laws (all ages: IRR = 1.12, 95% CI:

1.03, 1.21; adults: IRR = 1.09, 95% CI: 1.01, 1.18) (Table 8B, 8E). The protective effect of training from the first set of models was limited to all-ages firearm suicide (IRR = 0.94, 95% CI: 0.89, 1.00), male firearm suicide (all ages and adults: IRR = 0.94, 95% CI: 0.89, 0.99), and female nonfirearm suicide (all ages and adults: IRR = 0.91, 95% CI: 0.84, 0.98). Suitability requirements were, again, only statistically significantly associated with female nonfirearm suicide (all ages: IRR = 0.86, 95% CI: 0.74, 0.98; adults: IRR = 0.87, 95% CI: 0.78, 0.98). The relationship between a good cause requirement and suicide was not statistically significant (Tables 8A–8F).

The interaction models were intended to reveal whether the relationship between training and suicide was modified by the overarching permitting scheme (may issue vs. shall issue—permitless laws and no issue laws, by default, would not have a training requirement). The results of these models suggest that training is protective in states with may issue laws, but not in states with shall issue laws (Tables 9A, 9B). When training was coupled with a may issue law, there was an 11.8% protective effect for all-ages firearm suicide (IRR = 0.89, 95% CI: 0.82, 0.97) and a 10% protective effect for adult firearm suicide (IRR = 0.90, 95% CI: 0.83, 0.97). This combination was also protective for male firearm suicide (all ages: IRR = 0.90, 95% CI: 0.83, 0.96; adults: IRR = 0.89, 95% CI: 0.83, 0.96), all-ages female firearm suicide (IRR = 0.87, 95% CI: 0.75, 1.00), and adult female nonfirearm suicide (IRR = 0.91, 95% CI: 0.83, 1.00). In no model was the shall issue–training combination statistically significant.

Synthetic Control Results

Synthetic control analyses were limited to the training requirement because it had the most consistent association with suicide mortality in the regression results. There

were 34 states that adopted a training requirement during the study period and were eligible for synthetic control analysis. Seventeen of those 34 had a pre-law mean squared prediction error (“MSPE”) less than 1. Because each synthetic control analysis is unique, there is no established method for identifying which models are acceptable. Analyses like this one are sensitive because the outcome is volatile and the donor pools are small. An MSPE of 1 was chosen as the cutoff point for determining the models with the best fit in an attempt to protect against these weaknesses. As in Manuscript 2, choosing this cutoff point ensured that the inferences drawn from the analysis, if any, would be conservative.

Among the states with an MSPE value less than 1—those with the best fit—the average change in the adult male firearm suicide mortality rate was -0.33% . The state-specific changes ranged from -17.9% (California) to $+10.6\%$ (Colorado) (Table 10). Because the regression results suggested that the training requirement may function differently under different overarching permitting laws, states with may issue laws and states with shall issue laws were separated (Fig 4).

States were sorted as “shall issue” if they had a shall issue law both before and after implementing a training requirement or if the training requirement was implemented coincidentally with a shall issue law. States were sorted as “may issue” in the same manner. The average change among shall issue states was 4.4% , with 17 of the 23 states seeing an increase in suicide mortality after implementing a training requirement (Fig 5). The average change among may issue states was -8.6% , with 4 of the 7 states seeing a decrease in suicide mortality after implementing a training requirement (Fig 6).

Five states had placebo test results that suggested statistical significance. In 2 of these states, however, there were very few donor states with sufficiently low MSPE

values, so the placebo test results may not be reliable. Of the remaining 3 states, California (-17.9%) and Texas (-15.5%) both saw decreases after implementing a training requirement and Colorado (+10.6%) saw an increase. Colorado and Texas both had shall issue laws coupled with their training requirements, while California had a may issue law. The graphs for each of these states (Synthetic Control Graphs Appendix), however, saw some separation between the treated state and the synthetic control, which may indicate the presence of some unobserved factor or that the actual effect is more muted.

DISCUSSION

Of the three concealed carry permitting requirements included in this analysis, only training has a consistent effect. Training requirements are protective, particularly when coupled with a may issue law. The regression and synthetic control results support the conclusion that training requirements can help reduce suicide, but the underlying mechanism is still unclear. Training requirements may directly affect suicide risk in a permitholder's household by encouraging storage practices and other safety measures, or training may be associated with other policies and enforcement that were unobserved in this study.

Though training requirements vary,¹⁷ acceptable courses usually cover safe storage practices. Adequate safe storage—locking a firearm when stored, storing a firearm unloaded, locking away ammunition, and storing ammunition separately from the firearm—has been shown to save lives.¹⁸ It is possible that gun owners who take the required training courses are more likely to practice safe storage or other safety measures.

This question needs additional research. A survey of safe storage practices following a training course could help illuminate the relationship.

Alternatively, training requirements may not have a direct relationship with suicide risk and may, instead, be serving as a proxy for some other state policy element. The interaction models and the synthetic control results show that training requirements are most consistently protective in states with may issue laws. There were 11 states that, at any point during the study period, had both of these policies. Of that group, 7 had both policies in 2015: California, Connecticut, Delaware, Hawaii, Maryland, Massachusetts, and New Jersey. Of these states, only Maryland had both policies for less than 10 years. These 7 states are notable for having some of the most robust firearm laws in the country. Though the regression analyses controlled for the firearm laws most likely to have a relationship with suicide risk—permit to purchase, point-of-sale background checks, and waiting periods—it is possible that these states are more likely to have other rigorous policies that reduce suicide risk. These states may also have better enforcement of concealed carry permitting laws. In other words, applicants may be less likely to succeed in these states. Because permitting data is difficult to obtain, this question is difficult to examine.

Good cause and suitability requirements were not consistently associated with changes in suicide mortality. In fact, the only statistically significant association was a protective effect of suitability requirements on female nonfirearm suicide. There is no theoretical mechanism that readily explains this result, suggesting the presence of some unobserved confounding variable affecting nonfirearm suicide deaths—the majority of suicide deaths—among females.

This study has a few other weaknesses. The synthetic control analyses were limited by the small number of states eligible to be donor states. Because the donor pools were so small, they could not be constrained further to account for other firearm laws like permit to purchase and waiting periods. Thus, important legal intricacies may have been missed in the synthetic control models. In addition, though each state's legal requirements for training are publicly available, it is not easy to ascertain whether training courses are actually meeting the statutory requirements. Also, as mentioned in Manuscript 2, permit holder-specific data is near impossible to obtain, meaning that the direct effects of concealed carry policies on permit holders is very difficult to measure.

Visual analysis of the synthetic control graphs also reveals that, in some states, the separation between the treated unit and the synthetic unit occurred just prior to implementation of the law. This could indicate that the observed effect is the result of some other, unobserved variable. It could also be indicative of error from poor fit. A more detailed state-specific analysis might help elucidate the reasons for the divergence.

This study has several strengths. It is the first study to examine these specific concealed carry policy details. Though some studies have addressed the protective effect of firearm safety practices, this is the first analysis of how training courses, in particular, affect suicide risk. Though the individual-level effects of concealed carry policies are difficult to measure, this analysis uses two rigorous statistical methods to support its conclusions about state policy. This study also serves as a starting point for future research on the relationship between public carrying, training, and suicide risk.

Future research should focus on analyzing different training requirements in more depth. Researchers should seek to document the content provided in training courses to

determine what is most effective for ensuring safe firearm practices. Future work should also examine other elements of concealed carry policy, including the length of time a permit is valid, age requirements, and others.

PUBLIC HEALTH IMPLICATIONS

Deregulation of concealed carry has a detrimental effect on public health. States with looser laws see more violent crime and, in the case of permitless carry laws, may see higher suicide rates. This research shows that a state's training requirement may be a silver lining. Required training courses offer a rare opportunity for noncriminal interactions between the state government and gun owners. This is an opportunity that many states take to discuss safe storage and use, but that very few use to discuss the relationship between firearms and suicide risk. This study suggests that training courses may be a key intervention point for suicide prevention. There are several efforts underway now to partner suicide prevention efforts with gun shops, gun ranges, and gun owners. These training courses, no matter who is offering them, would be an excellent next step.

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INTEGRATION

This dissertation research is broken into three manuscripts, but is intended to function as a cohesive, in-depth analysis of concealed carry policy in the United States and its relationship with suicide. State laws governing the concealed carry of firearms have not been rigorously studied. Existing research has focused primarily on broad policy categorizations—“Right to Carry” laws—and violent crime. This dissertation engages in a more detailed mapping of concealed carry laws and seeks to examine the relationship between these laws and suicide mortality, which accounts for the majority of firearm deaths.

The relationship between concealed carry and suicide is grounded in exposure. Expanded access to firearms increases the risk of death by suicide. Concealed carry laws increase exposure in at least three ways. First, individuals allowed to carry a concealed gun have access to that gun in more times and places. Second, concealed carry permits allow permit holders to eschew point-of-sale background check requirements when purchasing a new firearm. Finally, loose regulation of concealed carry may enhance sociocultural acceptance of firearms, which may increase access for both those with and without permits.

The first manuscript used traditional public health law research methods to map current state concealed carry policies and explain their evolution. This analysis sorted state laws into general categories used by other researchers and lawmakers—No Issue, May Issue, Shall Issue, and Permitless—but it also went a step further, examining and categorizing specific requirements in each state’s law. This systematic legal research revealed several important patterns. Concealed carry has become increasingly

deregulated over the last 30–40 years. In the 1990s and early 2000s, states shifted away from stricter regulation of concealed carry (including total bans) and toward more permissive permitting schemes. Laws allowing permitless carry were rare until 2010. Between 2010 and 2017, the number of permitless carry states quadrupled—from 3 at the end of 2010 to 12 at the end of 2017.

Of the states that required permits, there were three common types of requirement: (1) Good Cause, which required applicants to articulate a good reason for carrying a concealed firearm; (2) Suitability, which required the issuing agency to determine whether applicants were suitable persons to be licensed to carry a concealed weapon; and (3) Training, which required applicants to undergo some type of standardized training to be eligible for a permit.

This first manuscript described the legal landscape surrounding concealed carry laws, concluding that the Second Amendment only restrained state legislatures politically—concealed carry was not an activity at the core of the individual right articulated by the Supreme Court. This paper concluded by positing that deregulation of concealed carry could be associated with increased suicide mortality, but that training courses might offer a unique opportunity for suicide prevention interventions.

The second and third manuscripts engage in statistical analyses of the policies described in the first manuscript. Comparative interrupted time series and synthetic control analyses suggest that shall issue laws are not associated with suicide mortality. Laws allowing permitless carry were associated with marked increases in suicide—around 20% in the interrupted time series regression and 13% in the synthetic control analyses—but these results have an important caveat: There were only 4 states with a

permitless law at any point during the study period and 2 of those states adopted their laws after 2010. Thus, though permitless laws appear to be associated with suicide increases, the sample size might be too small to draw conclusive causal inferences.

The third manuscript used the same statistical techniques to evaluate the common specific requirements identified in the first manuscript—good cause, suitability, and training. Of the three, training was the only one with a consistent, statistically significant relationship with suicide. The presence of a training requirement was associated with a 5–6% protective effect on firearm suicide. The training variable was interacted with the shall issue variable to determine whether the protective effect of training was modified by the overall concealed carry permitting scheme. These results suggested that training was only protective in may issue states (~10% decrease in firearm suicide mortality in the overall population and among males). The relationship between training and may issue laws was also present in the synthetic control results.

Taken together, these findings have significant public health implications and point to important areas of future research. Concealed carry is becoming increasingly deregulated in the United States. Though shall issue laws are not associated with suicide risk, permitless laws may be associated with increased risk. As more states adopt permitless laws and have had permitless laws in place for several years, researchers should examine their relationship with suicide. Although shall issue and permitless laws are also associated with increased violent crime, a return to an era of may issue and no issue laws is not politically feasible. Instead, states should focus on resisting the shift toward permitless carry and on implementing rigorous, objective permitting policies.

As a part of these rigorous policies, states should seize on the protective promise of training-course interventions. This research demonstrates that training courses are associated with decreases in suicide, but the effect may be limited to may issue states. This limitation may indicate that the training requirement is serving as a proxy for some unobserved policy or enforcement variable, but this study still shows that training courses have a potential life-saving effect. Training courses offer states the opportunity to interact with law-abiding gun owners. It is incumbent upon state policymakers to adopt training course requirements that touch on public health concerns, including violence and suicide prevention strategies.

Future research should explore specific state training courses to determine the most effective strategies. Researchers could also design training-based interventions designed to help with suicide prevention. This would align nicely with current suicide-prevention partnerships between public health professionals, gun shops, gun range operators, and other gun owners. Future research should also examine other elements of concealed carry policy to see if additional restrictions or requirements have an effect on violent crime or suicide. Legal research should focus on the enforcement implications of permitless carry, including Fourth Amendment concerns.

This dissertation uses rigorous legal and empirical research methods to explore concealed carry policy and suicide in the United States. These findings help explain the relationship between firearms and suicide, safety training and suicide, and concealed carry and violent crime. The research presented in these manuscripts sets the stage for additional concealed carry research and provides a starting point for public health

professionals and policymakers seeking to reform concealed carry policy using a public health perspective.

APPENDIX: METHODS

This dissertation research used traditional public health law research methods, comparative interrupted time series regression analysis, and synthetic control methods. This appendix will describe each of these. Some of these descriptions are similar to descriptions that appear in the manuscripts but have been shortened or expanded as necessary. Suicide mortality data was obtained from the National Center for Health Statistics.¹ Demographic covariates were obtained from the United States Census,² the Bureau of Labor Statistics (1980–2016),³ the Religion and Congregation Membership Survey,⁴ and the National Institute on Alcohol Abuse and Alcoholism⁵ and interpolated for intercensal years for the statistical analyses.

Public Health Law Research Methods

This study used a traditional public health law legal epidemiology approach. State concealed carry laws were retrieved from the Thomson Reuters Westlaw (“Westlaw”) database. Laws were pulled from each state’s code using a series of standard search terms and manual searching. The search terms included “conceal*,” “gun or firearm,” “carry,” “permit or license,” “training,” “good cause,” “suitab*,” and others. The legislative history of each of these statutes was obtained from Westlaw and HeinOnline. Each state’s concealed carry statutes were tracked from 1980 to 2017. Specific legal requirements were also collected including training, suitability, and age. The state laws were then categorized and mapped from 1980 to 2017. Legal data was collected and analyzed for all 50 states. The legal coding was verified multiple times using the collected statutes and was compared against existing databases documenting the overall policy scheme (shall issue, may issue, or permitless).

Longitudinal Data Analysis: Comparative Interrupted Time Series

The primary method of longitudinal data analysis was a 50-state comparative interrupted time series analysis (CITS). The CITS analysis involved two pieces of similar design. One focused on the overall concealed carry policy (shall issue, may issue, no issue, or permitless). The other focused on three specific requirements underlying each of these policies (training, good cause, and suitability). The 50-state comparative interrupted time series analysis involved generalized linear models with a negative binomial distribution to account for over-dispersion in suicide mortality counts and robust standard errors to account for clustering by state. The exposure variable for each model was the total population at risk of joining the specific dependent variable suicide count (e.g., for a model analyzing state counts of overall suicide mortality, the exposure variable was total population. For a model analyzing the state counts of overall suicide mortality in individuals 20 and over, the exposure variable was total population aged 20 and over). Each model also accounted for state-level fixed effects and included quadratic year trend terms:

$$\ln(Y_{it}) = \beta_0 + \beta_1 L_{it} + \beta_2 T + \beta_3 S1_{it} + \dots + \beta_{51} S49_{it} + \beta X + \varepsilon_i$$

Y_{it} = suicide deaths in state i in year t

$L = 1$ if law of interest is implemented, 0 if not

T = Time trend

S_k = state indicator variables

βX = vector of covariates and their coefficients

The selection of control variables was informed by prior work on concealed carry laws,⁶ firearm homicide,⁷ and firearm suicide.⁸ These variables included state unemployment rate, state poverty rate, percent of the state population identified as male, percent of the

state population identified as veteran, percent of the state population identified as black, percent of the state population that is married, percent of the state population living in a metro statistical area, state ethanol consumption per capita (age 14 and up), state rate of religious adherence, and the percent of state population that has graduated from high school. To account for trends in the use of opioids, each model also accounted for the addict overdose rate by subtracting overdoses coded as deaths by suicide from the overall number of overdose deaths. The models also used the same set of legal covariates: permit to purchase laws, point of sale background check laws, waiting period laws, and mental health parity laws. The final covariates were selected based on their theoretical relationship with firearms and suicide and on statistical evaluation of the model fit using Aikake's Information Criterion. For each model, the best fit was the model including all the covariates listed here.

The negative binomial models used several different dependent variables: All state suicide mortality, all state suicide mortality without overdoses, state firearm suicide mortality, state nonfirearm suicide mortality, state nonfirearm suicide mortality without overdoses. These counts were also broken into gender and age categories: male, female, all ages, and decedents coded as 20 years of age or older. This group, aged 20 and older, were referred to as "adults" for the purposes of this study. The time period for all regression analyses was 1980–2015.

Several important decisions were made during the statistical analysis. First, overdoses were excluded from the overall suicide and nonfirearm suicide counts for some of the models. This was done because of concerns about the accuracy of overdose suicide counting. Unlike other methods, it can be difficult to determine whether an overdose is a

suicide or an accidental death. In addition, this helped avoid data issues related to current the opioid epidemic. Second, 20 was the cut-off for “adults.” This decision was made because of data availability (data was not available for all years for 18 and up) and because many concealed carry policies limit permitting to those 21 and older. 20 and up was the available age range that best approximate the group of individuals eligible to carry concealed weapons in any state. Third, interaction models only included training because training was the only one of the three requirements that had a statistically significant relationship with suicide. The other two requirements—good cause and suitability—did not appear to have a relationship with suicide mortality. In addition, the distribution of these requirements varied very little over the study period (1980–2015) whereas the number of states with a training requirement changed markedly.

An additional set of models were included for Manuscript 2. In these models, the independent variables reflected the number of years a law had been in place. These variables were coded as 1 for the year a shall issue or permitless law went into effect and the variable increased with each year the law was in effect up to 10. Once a law reached 10 for a given state, it remained there until the law was repealed or until the study period ended. Ten was chosen as a maximum because prior work by Donohue et al⁶ had suggested that the harmful effect of shall issue and permitless laws increased over the first 10 years that the law was in effect. These models excluded any state that would have had an independent variable equal to 10 for the entire study period. In other words, any state that had already had a shall issue or permitless law for 10 years prior to 1980 (a total of 4 states) was excluded.

Synthetic Control Methods

The synthetic control method involves constructing a synthetic version of a treated unit. By using a synthetic version of a treated unit, researchers can more closely approximate the applicable counterfactual, thereby coming closer to estimating a causal effect. The goal, in a policy study like this one, is to create a synthetic state that—aside from the policy at issue—is identical to the actual state. The synthetic state is constructed from a series of donor states. These states are those “at risk” of implementing the policy at issue. For example, if the policy at issue is a PTP law, the donor pool would consist of states that did not have a PTP law. The donor states are assigned weights such that the synthetic state closely approximates the treated state in the pre-intervention period. In other words, the chosen combination of weighted donor states will have the lowest mean squared prediction error (MSPE) in the pre-intervention period. Once the synthetic state is constructed, it can be compared to the treated state in the post-intervention period.⁹

Additional tests are required to enable researchers to make inferences about the comparison between the synthetic state and the treated state. These “placebo” tests iteratively run the same synthetic control process using donor states as the treated state. This process seeks to determine whether the observed treatment effect of interest is, in fact, rare among all included states. The placebo test will generate a proportion of donor states with results more extreme than the state of interest. This proportion is akin to a more traditional p-value.⁹

The synthetic control method has been used effectively for firearm violence and firearm suicide research, but it is essential to specify the model correctly. Synthetic control analyses may be sensitive to follow-up times, chosen control variables, and the length of the pretreatment period. The chosen control variables were initially identical to

the 50-state analysis described above, but a series of subsets of those variables was be tested using a cross-validation procedure to determine the set of control variables that minimizes the root mean squared error of post-law suicides for the donor pool states.¹⁰ The only demographic variable excluded for the synthetic control analyses was percent republican. The legal covariates cannot be easily included in these models. Because they are dichotomous, they can only be incorporated by limiting the donor pool to states that have identical legal infrastructures. The more laws included, the smaller the donor pool becomes. Because this analysis was already working with a small donor pool, the legal covariates were excluded from the synthetic control analyses.

The synthetic control analyses only examined one outcome—the adult male firearm suicide rate. This was chosen because male individuals are far more likely to use a firearm in a suicidal act and concealed carry laws have the most direct effect on individuals age 20 and older. Therefore, it was theorized that concealed carry laws would have the most direct effect on adult male firearm suicide. The analysis used a moving average of the mortality rate to improve the pre-law fit of the synthetic states. The synthetic control results were aggregated according to MSPE and may/shall issue law. The average post-law change was reported for states with an MSPE less than 1 overall and for each of the concealed carry policy categories. The placebo test results were also calculated for each of these states to determine whether the observed post-law changes suggested statistical significance.

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APPENDIX: TABLES AND FIGURES

Table 1

State Concealed Carry Laws, 1980–2017				
State	No Issue	May Issue	Shall Issue	Permitless
Alabama		Pre-1980– 8/1/13	8/1/13	
Alaska	Pre-1980– 10/1/94		10/1/94–9/9/03	9/9/03
Arizona	Pre-1980– 7/16/94		7/16/94– 7/28/10	7/28/10
Arkansas	Pre-1980– 7/27/94		7/27/94*	
California		Pre-1980		
Colorado	Pre-1980– 6/8/81	6/8/81–5/17/03	5/17/03*	
Connecticut		Pre-1980		
Delaware		Pre-1980		
Florida		Pre-1980– 10/1/87	10/1/87	
Georgia		Pre-1980– 8/25/89	8/25/89*	
Hawaii		Pre-1980		
Idaho		Pre-1980– 7/1/90	7/1/90–7/1/16	7/1/16
Illinois	Pre-1980– 1/5/14		1/5/14*	
Indiana			Pre-1980*	
Iowa		Pre-1980– 1/1/11	1/1/11*	
Kansas	Pre-1980– 1/1/07		1/1/07–7/1/15	7/1/15
Kentucky	Pre-1980– 10/1/96		10/1/96	
Louisiana	Pre-1980– 4/19/96		4/19/96	
Maine	Pre-1980– 9/18/81		9/18/81– 10/15/15	10/15/15
Maryland		Pre-1980		
Massachusetts		Pre-1980		
Michigan		Pre-1980– 7/1/01	7/1/01	
Minnesota		Pre-1980– 5/28/03	5/28/03*	

Mississippi	Pre-1980– 7/1/91		7/1/91–4/15/16	4/15/16
Missouri	Pre-1980– 2/26/04		2/26/04– 1/1/17*	1/1/17
Montana		Pre-1980– 10/1/91	10/1/91*	
Nebraska	Pre-1980– 1/1/07		1/1/07	
Nevada		Pre-1980– 10/1/95	10/1/95	
New Hampshire			Pre-1980– 2/22/17*	2/22/17
New Jersey		Pre-1980		
New Mexico	Pre-1980– 1/1/04		1/1/04	
New York		Pre-1980		
North Carolina	Pre-1980– 12/1/95		12/1/95	
North Dakota	Pre-1980– 8/1/85		8/1/85–8/1/17	8/1/17
Ohio	Pre-1980– 4/8/04		4/8/04	
Oklahoma	Pre-1980– 9/1/95		9/1/95	
Oregon		Pre-1980– 1/1/90	1/1/90*	
Pennsylvania		Pre-1980– 6/17/89	6/17/89*	
Rhode Island			Pre-1980*	
South Carolina		Pre-1980– 8/23/96	8/23/96	
South Dakota		Pre-1980– 7/1/85	7/1/85	
Tennessee	Pre-1980– 11/1/89	11/1/89– 10/1/96	10/1/96	
Texas	Pre-1980– 1/1/96		1/1/96	
Utah		Pre-1980– 5/1/95	5/1/95*	
Vermont				Pre-1980
Virginia		Pre-1980– 7/1/95	7/1/95*	
Washington			Pre-1980	
West Virginia		Pre-1980– 7/7/89	7/7/89–5/24/16	5/24/16

Wisconsin	Pre-1980– 11/1/11		11/1/11	
Wyoming	Pre-1980– 7/1/83	7/1/83–10/1/94	10/1/94– 7/1/11*	7/1/11

* Shall issue law with some limited discretion afforded to the issuing body.

Table 2

State Concealed Carry Permit Requirements, 1980–2017				
State	Training	Live Fire	Good Cause	Suitability
Alabama			Pre-1980– 8/1/13	Pre-1980– 8/1/13
Alaska	10/1/94–9/9/03	10/1/94–9/9/03		
Arizona	7/16/94– 7/28/10			
Arkansas	7/27/94			
California	1/1/99		Pre-1980	Pre-1980
Colorado	5/17/03			
Connecticut	10/1/94			Pre-1980
Delaware	5/13/98	5/13/98	Pre-1980	Pre-1980
Florida	10/1/87	4/1/16		Pre-1980– 10/1/87
Georgia				Pre-1980
Hawaii	7/1/95*	7/1/95*	Pre-1980	Pre-1980
Idaho	7/1/90–7/1/16		Pre-1980– 7/1/90	
Illinois	1/5/14	1/5/14		
Indiana			Pre-1980	Pre-1980
Iowa	1/1/11			
Kansas	1/1/07–7/1/15	1/1/07–7/1/15		
Kentucky	10/1/96	10/1/96		
Louisiana	4/19/96			
Maine	4/24/90– 10/15/15			9/18/81– 10/15/15
Maryland	10/1/13	10/1/13	Pre-1980	
Massachusetts	4/1/99		Pre-1980	Pre-1980
Michigan	7/1/01	7/1/01	Pre-1980– 7/1/01	Pre-1980– 7/1/01
Minnesota	5/28/03	5/28/03		
Mississippi				
Missouri	2/26/04–1/1/17	2/26/04–1/1/17		
Montana	10/1/91			Pre-1980
Nebraska	1/1/07	1/1/07		
Nevada	10/1/95			
New Hampshire			Pre-1980– 2/22/17	Pre-1980– 2/22/17

New Jersey	Pre-1980		Pre-1980	Pre-1980
New Mexico	1/1/04	1/1/04		Pre-1980
New York				
North Carolina	12/1/95	12/1/95		
North Dakota	8/1/85–8/1/17	8/1/85–8/1/17	8/1/85–8/1/13	
Ohio	4/8/04	4/8/04	4/8/04	
Oklahoma	9/1/95	9/1/95		
Oregon	1/1/90		Pre-1980– 1/1/90	Pre-1980– 1/1/90
Pennsylvania			Pre-1980	Pre-1980
Rhode Island		Pre-1980	Pre-1980	Pre-1980
South Carolina	Pre-1980	Pre-1980		
South Dakota			Pre-1980	Pre-1980
Tennessee	11/1/89	11/1/89		
Texas	1/1/96	1/1/96		
Utah	4/28/86		Pre-1980– 5/1/95	Pre-1980– 5/11/10
Vermont				
Virginia	7/1/04		Pre-1980– 7/1/95	Pre-1980– 7/1/95
Washington				
West Virginia	Pre-1980– 5/24/16		Pre-1980– 7/7/89	Pre-1980– 7/7/89
Wisconsin	11/1/11			
Wyoming	10/1/94–7/1/11			7/1/83–10/1/94

*Hawaii requires training and live fire for a license to possess, which would be a prerequisite for carrying a concealed weapon.

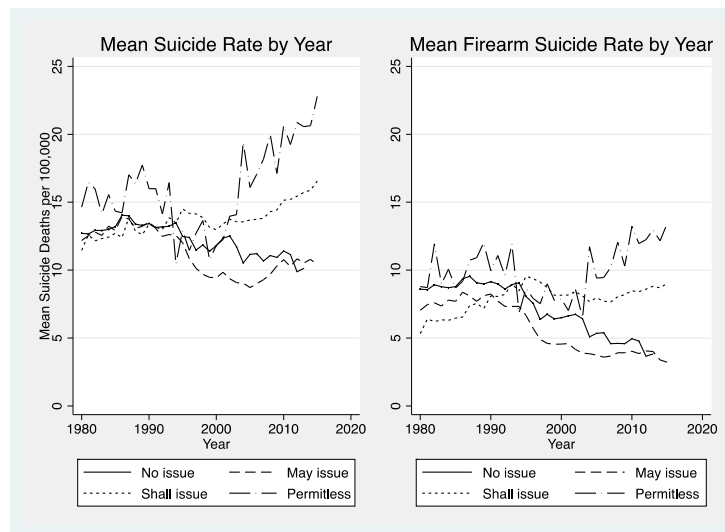


FIG 1

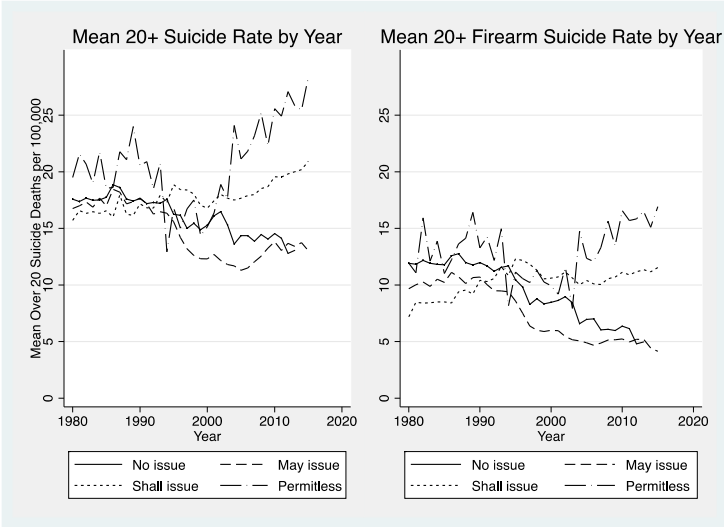


FIG 2

Table 3

Mean Suicide Rates Across States, 1980–2015					
Population	Mean Crude Suicide Rate	Mean Crude Suicide Rate, No OD	Mean Crude Firearm Suicide Rate	Mean Crude Nonfirearm Suicide Rate	Mean Crude Nonfirearm Suicide Rate, No OD
Total	13.26	11.88	7.74	5.52	4.14
All Adults	17.29	15.41	10.14	7.15	5.27
All Males	21.50	20.22	13.64	7.87	6.59
Adult Males	28.49	28.92	18.51	9.98	8.20
All Females	5.25	3.78	2.01	3.24	1.76
Adult Females	6.77	4.79	2.64	4.13	2.14

*All rates per 100,000 individual

Table 4A

Comparative Interrupted Time Series Results: Total Population, No OD						
	All Suicide, No OD		Firearm Suicide		Nonfirearm Suicide, No OD	
	IRR	95% CI	IRR	95% CI	IRR	95% CI
Shall Issue	0.993	[0.96,1.03]	1.014	[0.97,1.06]	1.030	[0.99,1.07]
Permitless	1.109*	[1.01,1.22]	1.197*	[1.06,1.36]	1.123*	[1.06,1.19]
Waiting Periods	0.980	[0.94,1.02]	0.961	[0.91,1.01]	0.973	[0.93,1.02]
Permit to Purchase	0.919*	[0.88,0.96]	0.869*	[0.82,0.92]	0.988	[0.92,1.06]
CBC Only	0.953	[0.90,1.01]	0.954	[0.88,1.03]	0.964	[0.92,1.01]
Parity Law	0.948*	[0.91,0.98]	0.937*	[0.90,0.97]	0.978	[0.94,1.01]
Unemployment Rate	0.995*	[0.99,1.00]	0.993*	[0.99,1.00]	0.998	[0.99,1.00]
% Poverty	1.001	[1.00,1.00]	1.002	[1.00,1.01]	0.995	[0.99,1.00]
% Male	0.963	[0.89,1.04]	1.033	[0.94,1.14]	0.933	[0.87,1.00]

% Black	0.980*	[0.96,1.00]	0.991	[0.97,1.01]	0.966*	[0.95,0.98]
% Married	0.995	[0.99,1.00]	0.995	[0.99,1.00]	0.980*	[0.97,0.99]
% Veteran	1.031*	[1.02,1.04]	1.026*	[1.01,1.04]	1.039*	[1.02,1.06]
% Living in MSA	0.998*	[1.00,1.00]	1.000	[1.00,1.00]	1.001	[1.00,1.00]
Ethanol Consumption per capita	1.125*	[1.05,1.21]	1.158*	[1.07,1.25]	0.996	[0.92,1.09]
% Religious Adherence	1.002	[1.00,1.01]	1.003	[1.00,1.01]	1.003	[1.00,1.01]
% With H.S. Diploma	1.005	[1.00,1.01]	1.008*	[1.00,1.01]	1.012*	[1.00,1.02]
% Republican	0.997*	[1.00,1.00]	0.993*	[0.99,0.99]	1.004*	[1.00,1.01]
Addict OD Rate	1.002	[1.00,1.01]	1.002	[1.00,1.01]	1.005*	[1.00,1.01]

Table 4B

Comparative Interrupted Time Series Results: Total Female Population, No OD						
	Female Suicide, No OD		Female Firearm Suicide		Female Nonfirearm Suicide, No OD	
	IRR	95% CI	IRR	95% CI	IRR	95% CI
Shall Issue	0.989	[0.94,1.04]	1.012	[0.95,1.08]	1.063*	[1.01,1.12]
Permitless	1.129	[1.00,1.28]	1.228*	[1.06,1.43]	1.265*	[1.11,1.44]
Waiting Periods	0.952	[0.90,1.01]	0.916*	[0.84,1.00]	0.937	[0.85,1.03]
Permit to Purchase	0.918*	[0.86,0.99]	0.716*	[0.55,0.92]	1.049	[0.95,1.16]
CBC Only	0.955	[0.88,1.03]	0.916	[0.83,1.01]	1.006	[0.91,1.12]
Parity Law	0.947*	[0.90,1.00]	0.950	[0.89,1.02]	0.957	[0.90,1.01]
Unemployment Rate	0.995	[0.99,1.00]	0.993	[0.98,1.00]	0.997	[0.99,1.01]
% Poverty	0.998	[0.99,1.01]	1.000	[0.99,1.01]	0.990	[0.98,1.00]
% Male	0.918	[0.82,1.03]	1.058	[0.93,1.20]	0.845*	[0.74,0.97]
% Black	0.970*	[0.94,1.00]	1.004	[0.96,1.05]	0.950*	[0.91,0.99]
% Married	0.997	[0.99,1.01]	1.000	[0.98,1.02]	0.978*	[0.97,0.99]
% Veteran	1.034*	[1.02,1.05]	1.028*	[1.00,1.05]	1.040*	[1.02,1.07]
% Living in MSA	1.000	[1.00,1.00]	0.999	[0.99,1.00]	1.006*	[1.00,1.01]

Ethanol Consumption per capita	1.057	[0.95,1.17]	1.187*	[1.05,1.34]	0.857	[0.72,1.01]
% Religious Adherence	0.998	[0.99,1.00]	1.001	[0.99,1.01]	1.000	[0.99,1.01]
% With H.S. Diploma	1.004	[0.99,1.01]	1.009	[1.00,1.02]	1.011	[1.00,1.02]
% Republican	0.996*	[0.99,1.00]	0.988*	[0.98,0.99]	1.005*	[1.00,1.01]
Addict OD Rate	1.000	[0.99,1.01]	1.000	[0.99,1.01]	1.001	[0.99,1.01]

Table 4C

Comparative Interrupted Time Series Results: Total Male Population, No OD						
	Male Suicide, No OD		Male Firearm Suicide		Male Nonfirearm Suicide, No OD	
	IRR	95% CI	IRR	95% CI	IRR	95% CI
Shall Issue	0.993	[0.96,1.03]	1.017	[0.98,1.06]	1.019	[0.98,1.06]
Permitless	1.103*	[1.01,1.21]	1.194*	[1.06,1.35]	1.084*	[1.04,1.14]
Waiting Periods	0.987	[0.95,1.02]	0.967	[0.92,1.02]	0.985	[0.94,1.03]
Permit to Purchase	0.920*	[0.89,0.95]	0.888*	[0.85,0.93]	0.972	[0.91,1.04]
CBC Only	0.952	[0.90,1.01]	0.959	[0.89,1.03]	0.955*	[0.92,0.99]
Parity Law	0.948*	[0.91,0.98]	0.933*	[0.90,0.97]	0.984	[0.95,1.02]
Unemployment Rate	0.996	[0.99,1.00]	0.993*	[0.99,1.00]	0.999	[0.99,1.00]
% Poverty	1.002	[1.00,1.01]	1.003	[1.00,1.01]	0.996	[0.99,1.00]
% Male	0.959	[0.89,1.03]	1.013	[0.92,1.12]	0.948	[0.89,1.01]
% Black	0.983	[0.97,1.00]	0.989	[0.97,1.01]	0.971*	[0.96,0.99]
% Married	0.994	[0.99,1.00]	0.993	[0.99,1.00]	0.981*	[0.97,0.99]
% Veteran	1.030*	[1.02,1.04]	1.026*	[1.01,1.04]	1.038*	[1.02,1.06]
% Living in MSA	0.998*	[1.00,1.00]	1.000	[1.00,1.00]	0.999	[1.00,1.00]
Ethanol Consumption per capita	1.140*	[1.06,1.22]	1.158*	[1.07,1.25]	1.039	[0.96,1.13]
% Religious Adherence	1.002	[1.00,1.01]	1.004	[1.00,1.01]	1.004*	[1.00,1.01]
% With H.S. Diploma	1.006*	[1.00,1.01]	1.008*	[1.00,1.01]	1.013*	[1.01,1.02]
% Republican	0.997*	[1.00,1.00]	0.994*	[0.99,1.00]	1.004*	[1.00,1.01]

Addict OD Rate	1.003	[1.00,1.01]	1.002	[1.00,1.01]	1.006*	[1.00,1.01]
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Table 4D

Comparative Interrupted Time Series Results: Total Adult Population, No OD						
	20+ Suicide, No OD		20+ Firearm Suicide		20+ Nonfirearm Suicide, No OD	
	IRR	95% CI	IRR	95% CI	IRR	95% CI
Shall Issue	0.992	[0.96,1.02]	1.013	[0.97,1.05]	1.022	[0.99,1.06]
Permitless	1.117	[0.99,1.25]	1.201*	[1.04,1.39]	1.119*	[1.04,1.21]
Waiting Periods	0.976	[0.94,1.01]	0.957	[0.91,1.00]	0.973	[0.93,1.02]
Permit to Purchase	0.922*	[0.89,0.96]	0.875*	[0.83,0.92]	0.992	[0.93,1.06]
CBC Only	0.957	[0.91,1.00]	0.956	[0.89,1.03]	0.968	[0.93,1.01]
Parity Law	0.955*	[0.92,0.99]	0.946*	[0.91,0.98]	0.980	[0.95,1.02]
Unemployment Rate	0.998	[0.99,1.00]	0.995	[0.99,1.00]	1.000	[0.99,1.01]
% Poverty	1.001	[1.00,1.01]	1.003	[1.00,1.01]	0.995	[0.99,1.00]
% Male	0.988	[0.92,1.06]	1.054	[0.96,1.15]	0.953	[0.89,1.02]
% Black	0.983	[0.97,1.00]	0.994	[0.97,1.02]	0.969*	[0.95,0.99]
% Married	0.995	[0.99,1.00]	0.996	[0.99,1.00]	0.981*	[0.97,0.99]
% Veteran	1.029*	[1.02,1.04]	1.024*	[1.01,1.04]	1.038*	[1.02,1.06]
% Living in MSA	0.998*	[1.00,1.00]	0.999	[1.00,1.00]	1.001	[1.00,1.00]
Ethanol Consumption per capita	1.097*	[1.03,1.17]	1.143*	[1.06,1.23]	0.955	[0.88,1.03]
% Religious Adherence	1.001	[1.00,1.00]	1.003	[1.00,1.01]	1.003	[1.00,1.01]
% With H.S. Diploma	1.005	[1.00,1.01]	1.006	[1.00,1.01]	1.013*	[1.01,1.02]
% Republican	0.997*	[1.00,1.00]	0.994*	[0.99,1.00]	1.003*	[1.00,1.01]
Addict OD Rate	1.003	[1.00,1.01]	1.002	[1.00,1.01]	1.006*	[1.00,1.01]

Table 4E

Comparative Interrupted Time Series Results: Total Adult Female Population, No OD						
	20+ Female Suicide, No OD		20+ Female Firearm Suicide		20+ Female Nonfirearm Suicide, No OD	
	IRR	95% CI	IRR	95% CI	IRR	95% CI
Shall Issue	0.990	[0.95,1.04]	1.013	[0.95,1.09]	1.032	[0.98,1.09]
Permitless	1.143*	[1.01,1.30]	1.284*	[1.06,1.56]	1.146*	[1.01,1.30]
Waiting Periods	0.955	[0.91,1.01]	0.919	[0.84,1.00]	0.957	[0.87,1.05]
Permit to Purchase	0.926*	[0.86,0.99]	0.721*	[0.55,0.94]	1.057	[0.95,1.17]
CBC Only	0.958	[0.88,1.04]	0.903*	[0.82,0.99]	1.023	[0.93,1.13]
Parity Law	0.955	[0.91,1.00]	0.968	[0.90,1.04]	0.949	[0.90,1.00]
Unemployment Rate	0.997	[0.99,1.00]	0.998	[0.99,1.01]	0.998	[0.99,1.01]
% Poverty	0.998	[0.99,1.01]	1.000	[0.99,1.01]	0.992	[0.98,1.00]
% Male	0.951	[0.85,1.06]	1.091	[0.95,1.25]	0.867*	[0.77,0.97]
% Black	0.969*	[0.94,1.00]	1.004	[0.97,1.04]	0.953*	[0.91,1.00]
% Married	0.996	[0.99,1.01]	1.004	[0.99,1.02]	0.976*	[0.96,0.99]
% Veteran	1.034*	[1.01,1.05]	1.027*	[1.00,1.05]	1.039*	[1.01,1.07]
% Living in MSA	1.000	[1.00,1.00]	1.000	[1.00,1.00]	1.003*	[1.00,1.01]
Ethanol Consumption per capita	1.024	[0.92,1.14]	1.202*	[1.07,1.35]	0.808*	[0.67,0.98]
% Religious Adherence	0.998	[0.99,1.00]	1.002	[0.99,1.01]	0.998	[0.99,1.00]
% With H.S. Diploma	1.005	[1.00,1.01]	1.007	[1.00,1.02]	1.011	[1.00,1.02]
% Republican	0.997*	[0.99,1.00]	0.989*	[0.99,0.99]	1.003	[1.00,1.01]
Addict OD Rate	1.000	[0.99,1.01]	1.000	[0.99,1.01]	0.999	[0.99,1.01]

Table 4F

Comparative Interrupted Time Series Results: Total Adult Male Population, No OD						
	20+ Male Suicide, No OD		20+ Male Firearm Suicide		20+ Male Nonfirearm Suicide, No OD	
	IRR	95% CI	IRR	95% CI	IRR	95% CI
Shall Issue	0.992	[0.96,1.02]	1.018	[0.98,1.06]	0.999	[0.97,1.03]
Permitless	1.112	[0.99,1.25]	1.238*	[1.05,1.46]	0.944	[0.88,1.02]
Waiting Periods	0.981	[0.95,1.02]	0.966	[0.92,1.02]	0.979	[0.94,1.03]
Permit to Purchase	0.923*	[0.89,0.96]	0.899*	[0.86,0.94]	0.958	[0.90,1.02]
CBC Only	0.956	[0.91,1.01]	0.965	[0.90,1.04]	0.952*	[0.92,0.98]
Parity Law	0.954*	[0.92,0.99]	0.948*	[0.91,0.98]	0.970	[0.93,1.01]
Unemployment Rate	0.998	[0.99,1.00]	0.996	[0.99,1.00]	0.998	[0.99,1.00]
% Poverty	1.002	[1.00,1.01]	1.004	[1.00,1.01]	0.997	[0.99,1.00]
% Male	0.975	[0.91,1.04]	1.033	[0.94,1.13]	0.939*	[0.88,1.00]
% Black	0.987	[0.97,1.00]	0.992	[0.97,1.01]	0.981*	[0.97,1.00]
% Married	0.995	[0.99,1.00]	0.997	[0.99,1.00]	0.981*	[0.97,0.99]
% Veteran	1.027*	[1.02,1.04]	1.027*	[1.02,1.04]	1.029*	[1.01,1.05]
% Living in MSA	0.998*	[1.00,1.00]	1.000	[1.00,1.00]	0.997*	[0.99,1.00]
Ethanol Consumption per capita	1.112*	[1.05,1.18]	1.162*	[1.07,1.26]	0.962	[0.89,1.04]
% Religious Adherence	1.002	[1.00,1.01]	1.004	[1.00,1.01]	1.002	[1.00,1.00]
% With H.S. Diploma	1.005	[1.00,1.01]	1.004	[1.00,1.01]	1.015*	[1.01,1.02]
% Republican	0.997*	[1.00,1.00]	0.996*	[0.99,1.00]	1.001	[1.00,1.00]
Addict OD Rate	1.003	[1.00,1.01]	1.002	[1.00,1.01]	1.004	[1.00,1.01]

Table 5A

Comparative Interrupted Time Series Results: Gradual Effect Legal Variables: Total Population, No OD						
	All Suicide, No OD		All Firearm Suicide		All Nonfirearm Suicide, No OD	
	IRR	95% CI	IRR	95% CI	IRR	95% CI
Shall Issue Gradual	1.000	[1.00,1.00]	1.004	[1.00,1.01]	1.003	[1.00,1.01]
Permitless Gradual	1.023*	[1.01,1.03]	1.038*	[1.03,1.05]	1.020*	[1.01,1.03]
Waiting Periods	0.978	[0.94,1.02]	0.957	[0.91,1.01]	0.971	[0.92,1.02]
Permit to Purchase	0.922*	[0.89,0.96]	0.877*	[0.83,0.93]	0.984	[0.92,1.06]
CBC Only	0.955	[0.90,1.01]	0.959	[0.89,1.03]	0.962	[0.92,1.01]
Parity Law	0.953*	[0.92,0.99]	0.940*	[0.90,0.98]	0.979	[0.94,1.02]
Unemployment Rate	0.995*	[0.99,1.00]	0.992*	[0.99,1.00]	0.998	[0.99,1.00]
% Poverty	1.002	[1.00,1.01]	1.003	[1.00,1.01]	0.996	[0.99,1.00]
% Male	0.967	[0.90,1.04]	1.031	[0.93,1.14]	0.936	[0.87,1.01]
% Black	0.979*	[0.96,1.00]	0.992	[0.97,1.02]	0.965*	[0.95,0.98]
% Married	0.995	[0.99,1.00]	0.995	[0.99,1.00]	0.979*	[0.97,0.99]
% Veteran	1.030*	[1.02,1.04]	1.025*	[1.01,1.04]	1.038*	[1.02,1.06]
% Living in MSA	0.998*	[1.00,1.00]	1.000	[1.00,1.00]	1.000	[1.00,1.00]
Ethanol Consumption per capita	1.128*	[1.04,1.22]	1.171*	[1.07,1.28]	0.979	[0.90,1.07]
% Religious Adherence	1.003	[1.00,1.01]	1.004	[1.00,1.01]	1.003	[1.00,1.01]
% With H.S. Diploma	1.006	[1.00,1.01]	1.007*	[1.00,1.01]	1.013*	[1.01,1.02]
% Republican	0.997*	[1.00,1.00]	0.993*	[0.99,1.00]	1.004*	[1.00,1.01]
Addict OD Rate	1.002	[1.00,1.01]	1.001	[1.00,1.01]	1.004	[1.00,1.01]

Table 5B

Comparative Interrupted Time Series Results: Gradual Effect Legal Variables: Total Female Population, No OD						
	All Female Suicide, No OD		All Female Firearm Suicide		All Female Nonfirearm Suicide, No OD	
	IRR	95% CI	IRR	95% CI	IRR	95% CI
Shall Issue Gradual	1.002	[1.00,1.01]	1.007	[1.00,1.02]	1.010*	[1.00,1.02]
Permitless Gradual	1.026*	[1.01,1.04]	1.049*	[1.03,1.07]	1.036*	[1.01,1.06]
Waiting Periods	0.948	[0.89,1.01]	0.911*	[0.84,0.99]	0.932	[0.84,1.03]
Permit to Purchase	0.926*	[0.86,1.00]	0.726*	[0.57,0.93]	1.054	[0.94,1.18]
CBC Only	0.960	[0.89,1.04]	0.923	[0.85,1.00]	1.007	[0.90,1.12]
Parity Law	0.948	[0.90,1.00]	0.950	[0.89,1.02]	0.951	[0.89,1.01]
Unemployment Rate	0.995	[0.99,1.00]	0.992	[0.98,1.00]	0.998	[0.99,1.01]
% Poverty	1.000	[0.99,1.01]	1.002	[0.99,1.01]	0.992	[0.98,1.00]
% Male	0.917	[0.81,1.03]	1.048	[0.91,1.20]	0.844*	[0.73,0.98]
% Black	0.973	[0.95,1.00]	1.012	[0.97,1.05]	0.953*	[0.91,0.99]
% Married	0.999	[0.99,1.01]	1.003	[0.99,1.02]	0.976*	[0.96,0.99]
% Veteran	1.035*	[1.02,1.05]	1.032*	[1.01,1.06]	1.040*	[1.01,1.07]
% Living in MSA	1.000	[1.00,1.00]	1.000	[1.00,1.00]	1.006*	[1.00,1.01]
Ethanol Consumption per capita	1.080	[0.96,1.21]	1.224*	[1.08,1.39]	0.859	[0.71,1.03]
% Religious Adherence	0.999	[0.99,1.01]	1.001	[0.99,1.01]	1.000	[0.99,1.01]
% With H.S. Diploma	1.003	[0.99,1.01]	1.007	[1.00,1.02]	1.011	[1.00,1.02]
% Republican	0.996*	[0.99,1.00]	0.989*	[0.99,0.99]	1.005*	[1.00,1.01]
Addict OD Rate	0.999	[0.99,1.01]	1.001	[0.99,1.01]	0.999	[0.99,1.01]

Table 5C

Comparative Interrupted Time Series Results: Gradual Effect Legal Variables: Total Male Population, No OD						
	All Male Suicide, No OD		All Male Firearm Suicide		All Male Nonfirearm Suicide, No OD	
	IRR	95% CI	IRR	95% CI	IRR	95% CI
Shall Issue Gradual	0.999	[0.99,1.00]	1.004	[1.00,1.01]	1.001	[1.00,1.01]
Permitless Gradual	1.022*	[1.01,1.03]	1.037*	[1.02,1.05]	1.016*	[1.00,1.03]
Waiting Periods	0.984	[0.95,1.02]	0.964	[0.92,1.01]	0.984	[0.94,1.03]
Permit to Purchase	0.923*	[0.89,0.96]	0.895*	[0.85,0.94]	0.966	[0.90,1.03]
CBC Only	0.953	[0.90,1.01]	0.964	[0.90,1.04]	0.952*	[0.91,0.99]
Parity Law	0.954*	[0.92,0.99]	0.937*	[0.90,0.98]	0.986	[0.95,1.02]
Unemployment Rate	0.995*	[0.99,1.00]	0.992*	[0.99,1.00]	0.998	[0.99,1.00]
% Poverty	1.002	[1.00,1.01]	1.004	[1.00,1.01]	0.997	[0.99,1.00]
% Male	0.964	[0.90,1.04]	1.012	[0.91,1.12]	0.951	[0.89,1.01]
% Black	0.981*	[0.96,1.00]	0.990	[0.97,1.01]	0.969*	[0.95,0.99]
% Married	0.994	[0.99,1.00]	0.993	[0.98,1.00]	0.980*	[0.97,0.99]
% Veteran	1.029*	[1.02,1.04]	1.024*	[1.01,1.04]	1.036*	[1.02,1.06]
% Living in MSA	0.998*	[1.00,1.00]	1.000	[1.00,1.00]	0.999	[1.00,1.00]
Ethanol Consumption per capita	1.138*	[1.06,1.23]	1.166*	[1.07,1.28]	1.016	[0.94,1.10]
% Religious Adherence	1.004	[1.00,1.01]	1.005	[1.00,1.01]	1.004*	[1.00,1.01]
% With H.S. Diploma	1.006*	[1.00,1.01]	1.008*	[1.00,1.01]	1.014*	[1.01,1.02]
% Republican	.997*	[1.00,1.00]	0.994*	[0.99,1.00]	1.004*	[1.00,1.01]
Addict OD Rate	1.002	[1.00,1.01]	1.001	[1.00,1.01]	1.006*	[1.00,1.01]

Table 5D

Comparative Interrupted Time Series Results: Gradual Effect Legal Variables: Total Adult Population, No OD						
	20+ Suicide, No OD		20+ Firearm Suicide		20+ Nonfirearm Suicide, No OD	
	IRR	95% CI	IRR	95% CI	IRR	95% CI
Shall Issue Gradual	1.000	[1.00,1.00]	1.004	[1.00,1.01]	1.003	[1.00,1.01]
Permitless Gradual	1.024*	[1.01,1.03]	1.038*	[1.03,1.05]	1.020*	[1.01,1.03]
Waiting Periods	0.973	[0.94,1.01]	0.953*	[0.91,1.00]	0.970	[0.92,1.02]
Permit to Purchase	0.927*	[0.89,0.96]	0.882*	[0.84,0.93]	0.992	[0.93,1.06]
CBC Only	0.959	[0.91,1.01]	0.961	[0.90,1.03]	0.967	[0.92,1.01]
Parity Law	0.958*	[0.92,0.99]	0.948*	[0.91,0.99]	0.979	[0.94,1.02]
Unemployment Rate	0.998	[0.99,1.00]	0.995	[0.99,1.00]	1.000	[0.99,1.01]
% Poverty	1.002	[1.00,1.01]	1.004	[1.00,1.01]	0.995	[0.99,1.00]
% Male	0.992	[0.92,1.07]	1.050	[0.95,1.16]	0.959	[0.89,1.03]
% Black	0.982	[0.96,1.00]	0.995	[0.97,1.02]	0.968*	[0.95,0.99]
% Married	0.996	[0.99,1.00]	0.996	[0.99,1.00]	0.980*	[0.97,0.99]
% Veteran	1.028*	[1.02,1.04]	1.023*	[1.01,1.04]	1.037*	[1.02,1.06]
% Living in MSA	0.998*	[1.00,1.00]	1.000	[1.00,1.00]	1.000	[1.00,1.00]
Ethanol Consumption per capita	1.097*	[1.02,1.18]	1.153*	[1.06,1.25]	0.938	[0.86,1.02]
% Religious Adherence	1.003	[1.00,1.01]	1.003	[1.00,1.01]	1.003	[1.00,1.01]
% With H.S. Diploma	1.005	[1.00,1.01]	1.006	[1.00,1.01]	1.014*	[1.01,1.02]
% Republican	0.997*	[1.00,1.00]	0.994*	[0.99,1.00]	1.003*	[1.00,1.01]
Addict OD Rate	1.002	[1.00,1.01]	1.001	[1.00,1.01]	1.004*	[1.00,1.01]

Table 5E

Comparative Interrupted Time Series Results: Gradual Effect Legal Variables: Total Adult Female Population, No OD						
	20+ Female Suicide, No OD		20+ Female Firearm Suicide		20+ Female Nonfirearm Suicide, No OD	
	IRR	95% CI	IRR	95% CI	IRR	95% CI
Shall Issue Gradual	1.002	[1.00,1.01]	1.007	[1.00,1.02]	1.005	[1.00,1.01]
Permitless Gradual	1.028*	[1.01,1.04]	1.055*	[1.04,1.07]	1.014	[0.99,1.04]
Waiting Periods	0.951	[0.90,1.00]	0.915*	[0.84,1.00]	0.953	[0.87,1.04]
Permit to Purchase	0.936	[0.87,1.01]	0.733*	[0.57,0.95]	1.064	[0.95,1.19]
CBC Only	0.963	[0.89,1.04]	0.911*	[0.84,0.99]	1.024	[0.92,1.14]
Parity Law	0.956	[0.91,1.01]	0.967	[0.90,1.04]	0.946	[0.89,1.00]
Unemployment Rate	0.998	[0.99,1.00]	0.996	[0.99,1.01]	1.000	[0.99,1.01]
% Poverty	1.000	[0.99,1.01]	1.002	[0.99,1.01]	0.993	[0.98,1.00]
% Male	0.951	[0.85,1.07]	1.082	[0.93,1.25]	0.872*	[0.77,0.99]
% Black	0.973	[0.95,1.00]	1.013	[0.98,1.05]	0.956*	[0.91,1.00]
% Married	0.997	[0.99,1.01]	1.008	[0.99,1.03]	0.973*	[0.96,0.99]
% Veteran	1.035*	[1.01,1.06]	1.031*	[1.00,1.06]	1.039*	[1.01,1.07]
% Living in MSA	1.000	[1.00,1.00]	1.001	[1.00,1.01]	1.003	[1.00,1.01]
Ethanol Consumption per capita	1.045	[0.93,1.18]	1.240*	[1.10,1.39]	0.806*	[0.66,0.99]
% Religious Adherence	1.000	[0.99,1.01]	1.002	[0.99,1.01]	0.999	[0.99,1.01]
% With H.S. Diploma	1.005	[1.00,1.01]	1.004	[0.99,1.02]	1.012	[1.00,1.02]
% Republican	0.997*	[0.99,1.00]	0.990*	[0.99,0.99]	1.003	[1.00,1.01]

Addict OD Rate	1.000	[0.99,1.01]	1.001	[0.99,1.01]	0.996	[0.99,1.00]
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Table 5F

Comparative Interrupted Time Series Results: Gradual Effect Legal Variables: Total Adult Male Population, No OD						
	20+ Male Suicide, No OD		20+ Male Firearm Suicide		20+ Male Nonfirearm Suicide, No OD	
	IRR	95% CI	IRR	95% CI	IRR	95% CI
Shall Issue Gradual	0.999	[1.00,1.00]	1.004	[1.00,1.01]	0.998	[0.99,1.00]
Permitless Gradual	1.023*	[1.01,1.03]	1.043*	[1.03,1.06]	0.993	[0.98,1.00]
Waiting Periods	0.978	[0.95,1.01]	0.963	[0.92,1.01]	0.978	[0.93,1.02]
Permit to Purchase	0.927*	[0.89,0.96]	0.906*	[0.86,0.95]	0.953	[0.89,1.02]
CBC Only	0.957	[0.91,1.01]	0.969	[0.90,1.04]	0.950*	[0.92,0.98]
Parity Law	0.958*	[0.92,0.99]	0.952*	[0.91,0.99]	0.971	[0.93,1.01]
Unemployment Rate	0.998	[0.99,1.00]	0.996	[0.99,1.00]	0.998	[0.99,1.00]
% Poverty	1.002	[1.00,1.01]	1.004	[1.00,1.01]	0.997	[0.99,1.00]
% Male	0.981	[0.91,1.05]	1.031	[0.93,1.14]	0.950	[0.90,1.01]
% Black	0.985	[0.97,1.00]	0.992	[0.97,1.02]	0.978*	[0.96,1.00]
% Married	0.995	[0.99,1.00]	0.997	[0.99,1.00]	0.980*	[0.97,0.99]
% Veteran	1.027*	[1.01,1.04]	1.026*	[1.01,1.04]	1.028*	[1.01,1.05]
% Living in MSA	0.998*	[1.00,1.00]	1.000	[1.00,1.00]	0.996*	[0.99,1.00]
Ethanol Consumption per capita	1.108*	[1.04,1.18]	1.166*	[1.06,1.28]	0.941	[0.87,1.02]
% Religious Adherence	1.003	[1.00,1.01]	1.004	[1.00,1.01]	1.003	[1.00,1.01]
% With H.S. Diploma	1.005	[1.00,1.01]	1.004	[1.00,1.01]	1.017*	[1.01,1.02]
% Republican	0.997*	[1.00,1.00]	0.996*	[0.99,1.00]	1.001	[1.00,1.00]

Addict OD Rate	1.002	[1.00,1.01]	1.002	[1.00,1.01]	1.003	[1.00,1.01]
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Table 6A

Synthetic Control Results: Shall Issue Laws, States with MSPE < 1					
State	Adult Male Firearm Suicide				
	MSPE	Change (%)	p20	p5	p2
Florida	0.199	-4.75	3/19 (0.16)	3/17 (0.18)	3/14 (0.21)
Georgia	0.250	-12.24	0/19 (0)	0/1 (0)	0/16 (0)
Michigan	0.601	7.00	1/9 (0.11)	1/7 (0.14)	0/3 (0)
Minnesota	0.839	21.71	0/9 (0)	0/9 (0)	0.5 (0)
Mississippi	0.798	3.41	4/18 (0.22)	4/17 (0.24)	4/17 (0.24)
North Carolina	0.312	-5.24	2/13 (0.15)	2/12 (0.17)	1/8 (0.13)
North Dakota	0.263	7.13	5/22 (0.23)	5/22 (0.23)	5/20 (0.25)
Oregon	0.212	9.71	2/19 (0.11)	2/17 (0.12)	1/14 (0.07)
Pennsylvania	0.048	6.95	3/17 (0.18)	2/13 (0.15)	1/7 (0.14)
South Dakota	0.471	1.98	10/22 (0.45)	10/22 (0.45)	10/22 (0.45)
Texas	0.692	-22.99	0/13 (0)	0/13 (0)	0/11 (0)
Virginia	0.256	-12.31	1/13 (0.08)	1/10 (0.1)	0/7 (0)
West Virginia	0.776	10.66	1/19 (0.05)	1/19 (0.05)	1/18 (0.06)

Table 6B

Synthetic Control Results: Permitless Laws, All Eligible States					
	Adult Male Firearm Suicide				
	MSPE	Change (%)	p20	p5	p2

Alaska	3.44	13.24	0/47 (0)	0/47 (0)	0/46 (0)
Arizona	0.093	1.02	20/44 (0.45)	17/38 (0.45)	10/30 (0.33)

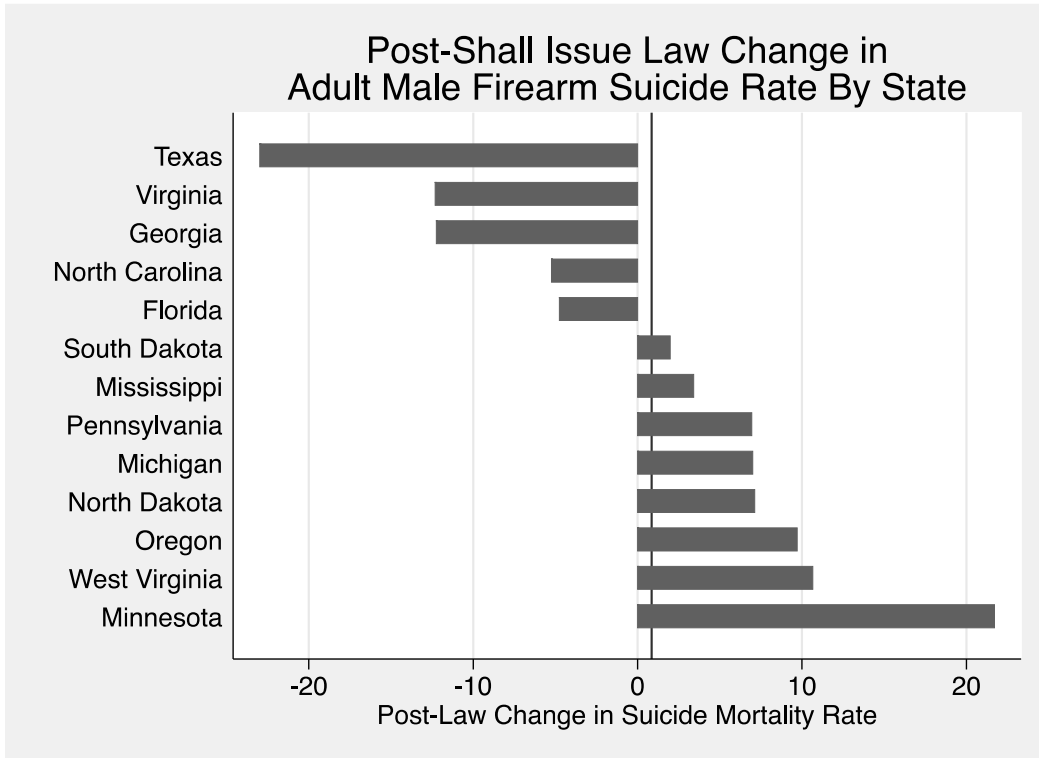


FIG 3

Table 7A

Comparative Interrupted Time Series Regression Results: Total Population, No OD						
	All Suicide, No OD		All Firearm Suicide		All Nonfirearm Suicide, No OD	
	IRR	95% CI	IRR	95% CI	IRR	95% CI
Training	0.968*	[0.95,0.99]	0.961*	[0.93,0.99]	0.989	[0.96,1.02]
Good Cause	1.000	[0.94,1.06]	0.999	[0.94,1.07]	1.018	[0.92,1.12]
Suitability	1.004	[0.95,1.06]	0.990	[0.93,1.06]	0.984	[0.91,1.06]
Waiting Periods	0.988	[0.95,1.03]	0.970	[0.92,1.02]	0.978	[0.93,1.03]
Permit to Purchase	0.929*	[0.89,0.96]	0.876*	[0.84,0.92]	0.986	[0.93,1.05]
CBC Only	0.950	[0.90,1.01]	0.951	[0.88,1.03]	0.963	[0.92,1.01]
Parity Law	0.945*	[0.91,0.98]	0.932*	[0.89,0.97]	0.976	[0.94,1.01]
Unemployment Rate	0.995*	[0.99,1.00]	0.992*	[0.99,1.00]	0.998	[0.99,1.00]

% Poverty	1.001	[1.00,1.01]	1.003	[1.00,1.01]	0.995	[0.99,1.00]
% Male	0.955	[0.88,1.03]	1.022	[0.92,1.13]	0.929	[0.86,1.01]
% Black	0.979*	[0.96,1.00]	0.987	[0.96,1.01]	0.962*	[0.94,0.98]
% Married	0.994	[0.99,1.00]	0.993	[0.98,1.00]	0.979*	[0.97,0.99]
% Veteran	1.031*	[1.02,1.04]	1.027*	[1.01,1.04]	1.039*	[1.02,1.06]
% Living in MSA	0.998*	[1.00,1.00]	0.999	[1.00,1.00]	1.001	[1.00,1.00]
Ethanol Consumption per capita	1.125*	[1.04,1.21]	1.150*	[1.05,1.25]	0.990	[0.91,1.08]
% Religious Adherence	1.002	[1.00,1.01]	1.003	[1.00,1.01]	1.003	[1.00,1.01]
% With H.S. Diploma	1.004	[1.00,1.01]	1.006	[1.00,1.01]	1.012*	[1.00,1.02]
% Republican	0.997*	[1.00,1.00]	0.994*	[0.99,1.00]	1.004*	[1.00,1.01]
Addict OD Rate	1.003	[1.00,1.01]	1.002	[1.00,1.01]	1.006*	[1.00,1.01]

Table 7B

Comparative Interrupted Time Series Regression Results: Total Female Population, No OD						
	All Female Suicide, No OD		All Female Firearm Suicide		All Female Nonfirearm Suicide, No OD	
	IRR	95% CI	IRR	95% CI	IRR	95% CI
Training	0.956*	[0.92,0.99]	0.957	[0.90,1.02]	0.965	[0.92,1.01]
Good Cause	1.013	[0.90,1.14]	0.940	[0.85,1.04]	1.126	[0.96,1.32]
Suitability	0.954	[0.88,1.03]	1.029	[0.95,1.11]	0.826*	[0.72,0.95]
Waiting Periods	0.953	[0.90,1.01]	0.931	[0.86,1.01]	0.923	[0.84,1.02]
Permit to Purchase	0.929*	[0.87,0.99]	0.722*	[0.57,0.91]	1.039	[0.93,1.17]
CBC Only	0.955	[0.88,1.03]	0.912	[0.83,1.01]	1.011	[0.90,1.13]
Parity Law	0.943*	[0.89,1.00]	0.944	[0.88,1.01]	0.951	[0.90,1.01]
Unemployment Rate	0.994	[0.99,1.00]	0.992	[0.98,1.00]	0.997	[0.99,1.01]
% Poverty	0.998	[0.99,1.01]	1.001	[0.99,1.01]	0.989*	[0.98,1.00]
% Male	0.903	[0.80,1.01]	1.050	[0.92,1.20]	0.823*	[0.71,0.95]
% Black	0.968*	[0.94,0.99]	1.002	[0.96,1.04]	0.941*	[0.90,0.98]

% Married	0.997	[0.99,1.01]	0.997	[0.98,1.01]	0.975*	[0.96,0.99]
% Veteran	1.033*	[1.01,1.05]	1.031*	[1.01,1.06]	1.036*	[1.01,1.06]
% Living in MSA	1.000	[1.00,1.00]	0.999	[0.99,1.00]	1.008*	[1.00,1.01]
Ethanol Consumption per capita	1.057	[0.95,1.18]	1.175*	[1.04,1.33]	0.845	[0.71,1.00]
% Religious Adherence	0.997	[0.99,1.00]	1.001	[0.99,1.01]	0.998	[0.99,1.01]
% With H.S. Diploma	1.002	[0.99,1.01]	1.008	[1.00,1.02]	1.009	[1.00,1.02]
% Republican	0.996*	[0.99,1.00]	0.988*	[0.98,0.99]	1.006*	[1.00,1.01]
Addict OD Rate	1.000	[0.99,1.01]	1.000	[0.99,1.01]	1.001	[0.99,1.01]

Table 7C

Comparative Interrupted Time Series Regression Results: Total Male Population, No OD						
	All Male Suicide, No OD		All Male Firearm Suicide		All Male Nonfirearm Suicide, No OD	
	IRR	95% CI	IRR	95% CI	IRR	95% CI
Training	0.970*	[0.95,0.99]	0.963*	[0.93,0.99]	0.995	[0.96,1.03]
Good Cause	0.998	[0.95,1.05]	1.007	[0.95,1.07]	0.993	[0.90,1.09]
Suitability	1.013	[0.96,1.07]	0.985	[0.92,1.05]	1.030	[0.95,1.11]
Waiting Periods	0.996	[0.96,1.03]	0.976	[0.93,1.03]	0.994	[0.95,1.04]
Permit to Purchase	0.930*	[0.90,0.96]	0.894*	[0.85,0.94]	0.972	[0.91,1.04]
CBC Only	0.949	[0.90,1.01]	0.957	[0.88,1.04]	0.952*	[0.92,0.99]
Parity Law	0.945*	[0.91,0.98]	0.929*	[0.89,0.97]	0.983	[0.95,1.02]
Unemployment Rate	0.995	[0.99,1.00]	0.992*	[0.99,1.00]	0.998	[0.99,1.00]
% Poverty	1.002	[1.00,1.01]	1.003	[1.00,1.01]	0.996	[0.99,1.00]
% Male	0.952	[0.89,1.02]	1.002	[0.91,1.11]	0.949	[0.89,1.01]
% Black	0.982*	[0.96,1.00]	0.986	[0.96,1.01]	0.969*	[0.95,0.98]
% Married	0.993*	[0.99,1.00]	0.991*	[0.98,1.00]	0.980*	[0.97,0.99]
% Veteran	1.030*	[1.02,1.04]	1.027*	[1.01,1.04]	1.039*	[1.02,1.06]
% Living in MSA	0.998*	[1.00,1.00]	1.000	[1.00,1.00]	0.999	[1.00,1.00]

Ethanol Consumption per capita	1.140*	[1.06,1.23]	1.150*	[1.05,1.26]	1.035	[0.95,1.12]
% Religious Adherence	1.002	[1.00,1.01]	1.003	[1.00,1.01]	1.004*	[1.00,1.01]
% With H.S. Diploma	1.005	[1.00,1.01]	1.006	[1.00,1.01]	1.013*	[1.01,1.02]
% Republican	0.997*	[1.00,1.00]	0.995*	[0.99,1.00]	1.004*	[1.00,1.01]
Addict OD Rate	1.003	[1.00,1.01]	1.002	[1.00,1.01]	1.007*	[1.00,1.01]

Table 7D

Comparative Interrupted Time Series Regression Results: Total Adult Population, No OD						
	20+ Suicide, No OD		20+ Firearm Suicide		20+ Nonfirearm Suicide, No OD	
	IRR	95% CI	IRR	95% CI	IRR	95% CI
Training	0.969*	[0.95,0.99]	0.964*	[0.93,1.00]	0.987	[0.96,1.02]
Good Cause	0.997	[0.95,1.04]	0.993	[0.94,1.05]	1.019	[0.94,1.10]
Suitability	1.003	[0.95,1.05]	0.995	[0.94,1.05]	0.983	[0.92,1.05]
Waiting Periods	0.983	[0.95,1.02]	0.966	[0.92,1.01]	0.976	[0.93,1.03]
Permit to Purchase	0.932*	[0.90,0.97]	0.882*	[0.84,0.92]	0.992	[0.93,1.05]
CBC Only	0.954	[0.91,1.00]	0.954	[0.88,1.03]	0.967	[0.93,1.01]
Parity Law	0.951*	[0.92,0.98]	0.941*	[0.91,0.98]	0.978	[0.94,1.01]
Unemployment Rate	0.997	[0.99,1.00]	0.995	[0.99,1.00]	1.000	[0.99,1.01]
% Poverty	1.002	[1.00,1.01]	1.003	[1.00,1.01]	0.995	[0.99,1.00]
% Male	0.979	[0.91,1.06]	1.043	[0.95,1.15]	0.947	[0.88,1.02]
% Black	0.982*	[0.97,1.00]	0.991	[0.97,1.01]	0.966*	[0.95,0.98]
% Married	0.995	[0.99,1.00]	0.994	[0.99,1.00]	0.980*	[0.97,0.99]
% Veteran	1.029*	[1.02,1.04]	1.025*	[1.01,1.04]	1.038*	[1.02,1.06]
% Living in MSA	0.998*	[1.00,1.00]	0.999	[1.00,1.00]	1.001	[1.00,1.00]
Ethanol Consumption per capita	1.096*	[1.02,1.17]	1.135*	[1.05,1.23]	0.949	[0.87,1.03]
% Religious Adherence	1.001	[1.00,1.00]	1.002	[1.00,1.01]	1.002	[1.00,1.01]

% With H.S. Diploma	1.004	[1.00,1.01]	1.005	[1.00,1.01]	1.012*	[1.00,1.02]
% Republican	0.997*	[1.00,1.00]	0.995*	[0.99,1.00]	1.003*	[1.00,1.01]
Addict OD Rate	1.003	[1.00,1.01]	1.002	[1.00,1.01]	1.006*	[1.00,1.01]

Table 7E

Comparative Interrupted Time Series Regression Results: Total Adult Female Population, No OD						
	20+ Female Suicide, No OD		20+ Female Firearm Suicide		20+ Female Nonfirearm Suicide, No OD	
	IRR	95% CI	IRR	95% CI	IRR	95% CI
Training	0.955*	[0.93,0.99]	0.959	[0.90,1.02]	0.952*	[0.91,1.00]
Good Cause	0.992	[0.92,1.07]	0.933	[0.86,1.01]	1.098	[0.97,1.24]
Suitability	0.968	[0.90,1.04]	1.037	[0.96,1.12]	0.852*	[0.76,0.96]
Waiting Periods	0.957	[0.91,1.01]	0.934	[0.85,1.02]	0.946	[0.86,1.04]
Permit to Purchase	0.936*	[0.88,1.00]	0.727*	[0.57,0.93]	1.057	[0.93,1.21]
CBC Only	0.956	[0.88,1.03]	0.899*	[0.81,0.99]	1.026	[0.93,1.14]
Parity Law	0.950*	[0.90,1.00]	0.960	[0.89,1.03]	0.945*	[0.89,1.00]
Unemployment Rate	0.997	[0.99,1.00]	0.996	[0.99,1.01]	0.998	[0.99,1.01]
% Poverty	0.999	[0.99,1.01]	1.001	[0.99,1.01]	0.991	[0.98,1.00]
% Male	0.936	[0.84,1.05]	1.083	[0.94,1.25]	0.845*	[0.75,0.95]
% Black	0.968*	[0.94,0.99]	1.002	[0.96,1.04]	0.947*	[0.91,0.99]
% Married	0.995	[0.99,1.00]	1.002	[0.99,1.02]	0.975*	[0.96,0.99]
% Veteran	1.034*	[1.01,1.05]	1.030*	[1.00,1.06]	1.036*	[1.01,1.06]
% Living in MSA	1.000	[1.00,1.00]	0.999	[0.99,1.00]	1.005*	[1.00,1.01]
Ethanol Consumption per capita	1.022	[0.92,1.14]	1.186*	[1.06,1.33]	0.805*	[0.67,0.97]
% Religious Adherence	0.998	[0.99,1.00]	1.001	[0.99,1.01]	0.996	[0.99,1.00]

% With H.S. Diploma	1.003	[0.99,1.01]	1.006	[0.99,1.02]	1.009	[1.00,1.02]
% Republican	0.997*	[0.99,1.00]	0.990*	[0.99,0.99]	1.004*	[1.00,1.01]
Addict OD Rate	1.000	[0.99,1.01]	1.000	[0.99,1.01]	0.999	[0.99,1.01]

Table 7F

Comparative Interrupted Time Series Regression Results: Total Adult Male Population, No OD						
	20+ Male Suicide, No OD		20+ Male Firearm Suicide		20+ Male Nonfirearm Suicide, No OD	
	IRR	95% CI	IRR	95% CI	IRR	95% CI
Training	0.972*	[0.95,0.99]	0.961*	[0.93,0.99]	1.005	[0.97,1.04]
Good Cause	0.999	[0.96,1.04]	1.015	[0.96,1.07]	0.972	[0.90,1.05]
Suitability	1.009	[0.96,1.06]	0.978	[0.92,1.04]	1.054	[0.96,1.16]
Waiting Periods	0.989	[0.95,1.02]	0.975	[0.93,1.03]	0.987	[0.94,1.04]
Permit to Purchase	0.933*	[0.90,0.97]	0.905*	[0.86,0.95]	0.960	[0.90,1.03]
CBC Only	0.953	[0.90,1.01]	0.962	[0.89,1.04]	0.951*	[0.92,0.98]
Parity Law	0.951*	[0.92,0.98]	0.942*	[0.91,0.98]	0.973	[0.93,1.01]
Unemployment Rate	0.997	[0.99,1.00]	0.995	[0.99,1.00]	0.998	[0.99,1.00]
% Poverty	1.002	[1.00,1.01]	1.004	[1.00,1.01]	0.997	[0.99,1.00]
% Male	0.967	[0.90,1.04]	1.020	[0.92,1.13]	0.946	[0.89,1.00]
% Black	0.986	[0.97,1.00]	0.988	[0.97,1.01]	0.982*	[0.97,1.00]
% Married	0.994	[0.99,1.00]	0.994	[0.99,1.00]	0.981*	[0.97,0.99]
% Veteran	1.027*	[1.01,1.04]	1.027*	[1.01,1.04]	1.030*	[1.01,1.05]
% Living in MSA	0.998*	[1.00,1.00]	1.000	[1.00,1.00]	0.996*	[0.99,1.00]
Ethanol Consumption per capita	1.111*	[1.04,1.19]	1.152*	[1.05,1.26]	0.965	[0.89,1.04]

% Religious Adherence	1.002	[1.00,1.01]	1.003	[1.00,1.01]	1.002	[1.00,1.01]
% With H.S. Diploma	1.004	[1.00,1.01]	1.003	[1.00,1.01]	1.016*	[1.01,1.02]
% Republican	0.998*	[1.00,1.00]	0.996*	[0.99,1.00]	1.001	[1.00,1.00]
Addict OD Rate	1.003	[1.00,1.01]	1.003	[1.00,1.01]	1.004	[1.00,1.01]

Table 8A

Comparative Interrupted Time Series Regression Results: Total Population, No OD						
	All Suicide, No OD		All Firearm Suicide		All Nonfirearm Suicide, No OD	
	IRR	95% CI	IRR	95% CI	IRR	95% CI
Shall Issue	1.020	[0.97,1.07]	1.059	[0.99,1.14]	1.063	[1.00,1.14]
Permitless	1.094*	[1.00,1.20]	1.168*	[1.04,1.31]	1.106*	[1.05,1.17]
Training	0.964	[0.93,1.00]	0.940*	[0.89,1.00]	0.959	[0.90,1.02]
Good Cause	1.001	[0.95,1.06]	1.004	[0.95,1.06]	1.024	[0.94,1.12]
Suitability	1.012	[0.96,1.07]	1.011	[0.94,1.08]	1.003	[0.93,1.08]
Waiting Periods	0.988	[0.95,1.02]	0.972	[0.93,1.02]	0.981	[0.93,1.04]
Permit to Purchase	0.935*	[0.90,0.97]	0.893*	[0.85,0.94]	1.008	[0.94,1.08]
CBC Only	0.950	[0.90,1.00]	0.951	[0.88,1.02]	0.961	[0.92,1.01]
Parity Law	0.948*	[0.91,0.98]	0.936*	[0.90,0.97]	0.978	[0.94,1.01]
Unemployment rate	0.996	[0.99,1.00]	0.993*	[0.99,1.00]	0.998	[0.99,1.00]
% Poverty	1.001	[1.00,1.01]	1.003	[1.00,1.01]	0.995	[0.99,1.00]
% Male	0.956	[0.89,1.03]	1.019	[0.93,1.12]	0.924*	[0.85,1.00]
% Black	0.981*	[0.96,1.00]	0.991	[0.97,1.02]	0.965*	[0.95,0.98]
% Married	0.995	[0.99,1.00]	0.996	[0.99,1.00]	0.981*	[0.97,0.99]
% Veteran	1.030*	[1.02,1.04]	1.025*	[1.01,1.04]	1.038*	[1.02,1.05]
% Living in MSA	0.998*	[1.00,1.00]	0.999	[1.00,1.00]	1.000	[1.00,1.00]

Ethanol Consumption per capita	1.134*	[1.06,1.22]	1.173*	[1.08,1.27]	1.006	[0.93,1.09]
% Religious Adherence	1.002	[1.00,1.01]	1.003	[1.00,1.01]	1.003	[1.00,1.01]
% With H.S. Diploma	1.004	[1.00,1.01]	1.006	[1.00,1.01]	1.011*	[1.00,1.02]
% Republican	0.997*	[1.00,1.00]	0.993*	[0.99,0.99]	1.004*	[1.00,1.01]
Addict OD Rate	1.002	[1.00,1.01]	1.002	[1.00,1.01]	1.006*	[1.00,1.01]

Table 8B

Comparative Interrupted Time Series Regression Results: Total Female Population, No OD						
	All Female Suicide, No OD		All Female Firearm Suicide		All Female Nonfirearm Suicide, No OD	
	IRR	95% CI	IRR	95% CI	IRR	95% CI
Shall Issue	1.014	[0.94,1.10]	1.056	[0.93,1.20]	1.120*	[1.03,1.21]
Permitless	1.102	[0.98,1.24]	1.200*	[1.04,1.38]	1.203*	[1.05,1.38]
Training	0.955	[0.90,1.02]	0.939	[0.83,1.06]	0.911*	[0.84,0.98]
Good Cause	1.013	[0.91,1.13]	0.945	[0.87,1.03]	1.142	[0.99,1.32]
Suitability	0.960	[0.89,1.04]	1.049	[0.97,1.14]	0.855*	[0.74,0.98]
Waiting Periods	0.952	[0.90,1.01]	0.931	[0.86,1.01]	0.927	[0.84,1.03]
Permit to Purchase	0.932*	[0.87,1.00]	0.736*	[0.58,0.93]	1.081	[0.95,1.23]
CBC Only	0.955	[0.88,1.03]	0.912*	[0.83,1.00]	1.007	[0.90,1.12]
Parity Law	0.946*	[0.90,1.00]	0.948	[0.89,1.02]	0.953	[0.90,1.01]
Unemployment rate	0.995	[0.99,1.00]	0.993	[0.98,1.00]	0.998	[0.99,1.01]
% Poverty	0.998	[0.99,1.01]	1.001	[0.99,1.01]	0.990*	[0.98,1.00]
% Male	0.905	[0.81,1.01]	1.049	[0.92,1.19]	0.812*	[0.70,0.94]
% Black	0.970*	[0.94,1.00]	1.005	[0.96,1.05]	0.947*	[0.91,0.98]
% Married	0.998	[0.99,1.01]	1.000	[0.98,1.02]	0.979*	[0.97,0.99]

% Veteran	1.032*	[1.01,1.05]	1.029*	[1.01,1.05]	1.034*	[1.01,1.06]
% Living in MSA	1.000	[1.00,1.00]	0.998	[0.99,1.00]	1.007*	[1.00,1.01]
Ethanol Consumption per capita	1.064	[0.96,1.18]	1.198*	[1.06,1.36]	0.873	[0.75,1.02]
% Religious Adherence	0.998	[0.99,1.00]	1.002	[1.00,1.01]	0.999	[0.99,1.01]
% With H.S. Diploma	1.003	[0.99,1.01]	1.008	[1.00,1.02]	1.007	[0.99,1.02]
% Republican	0.996*	[0.99,1.00]	0.988*	[0.98,0.99]	1.005*	[1.00,1.01]
Addict OD Rate	1.000	[0.99,1.01]	1.000	[0.99,1.01]	1.001	[0.99,1.01]

Table 8C

Comparative Interrupted Time Series Regression Results: Total Male Population, No OD						
	All Male Suicide, No OD		All Male Firearm Suicide		All Male Nonfirearm Suicide, No OD	
	IRR	95% CI	IRR	95% CI	IRR	95% CI
Shall Issue	1.020	[0.97,1.07]	1.064	[1.00,1.14]	1.045	[0.98,1.12]
Permitless	1.090	[1.00,1.19]	1.164*	[1.04,1.30]	1.079*	[1.03,1.13]
Training	0.965	[0.93,1.00]	0.938*	[0.89,0.99]	0.974	[0.92,1.04]
Good Cause	0.999	[0.95,1.05]	1.012	[0.96,1.06]	0.997	[0.92,1.09]
Suitability	1.021	[0.96,1.08]	1.006	[0.94,1.08]	1.045	[0.96,1.13]
Waiting Periods	0.996	[0.96,1.03]	0.978	[0.93,1.02]	0.997	[0.95,1.05]
Permit to Purchase	0.936*	[0.90,0.97]	0.913*	[0.87,0.96]	0.988	[0.92,1.06]
CBC Only	0.949	[0.90,1.00]	0.956	[0.89,1.03]	0.951*	[0.91,0.99]
Parity Law	0.948*	[0.92,0.98]	0.933*	[0.90,0.97]	0.985	[0.95,1.02]
Unemployment rate	0.996	[0.99,1.00]	0.993*	[0.99,1.00]	0.999	[0.99,1.00]
% Poverty	1.002	[1.00,1.01]	1.003	[1.00,1.01]	0.997	[0.99,1.00]
% Male	0.953	[0.89,1.02]	0.997	[0.91,1.09]	0.945	[0.89,1.01]
% Black	0.983	[0.97,1.00]	0.989	[0.97,1.01]	0.971*	[0.96,0.99]
% Married	0.994	[0.99,1.00]	0.994	[0.99,1.00]	0.982*	[0.97,0.99]
% Veteran	1.030*	[1.02,1.04]	1.025*	[1.01,1.04]	1.038*	[1.02,1.05]

% Living in MSA	0.998*	[1.00,1.00]	0.999	[1.00,1.00]	0.999	[1.00,1.00]
Ethanol Consumption per capita	1.149*	[1.07,1.23]	1.173*	[1.08,1.27]	1.047	[0.97,1.14]
% Religious Adherence	1.003	[1.00,1.01]	1.004	[1.00,1.01]	1.004*	[1.00,1.01]
% With H.S. Diploma	1.005	[1.00,1.01]	1.006	[1.00,1.01]	1.012*	[1.00,1.02]
% Republican	0.997*	[1.00,1.00]	0.994*	[0.99,1.00]	1.003*	[1.00,1.01]
Addict OD Rate	1.003	[1.00,1.01]	1.002	[1.00,1.01]	1.006*	[1.00,1.01]

Table 8D

Comparative Interrupted Time Series Regression Results: Total Adult Population, No OD						
	20+ Suicide, No OD		20+ Firearm Suicide		20+ Nonfirearm Suicide, No OD	
	IRR	95% CI	IRR	95% CI	IRR	95% CI
Shall Issue	1.015	[0.97,1.07]	1.053	[0.98,1.13]	1.049	[0.98,1.12]
Permitless	1.103	[0.99,1.23]	1.175*	[1.03,1.35]	1.104*	[1.03,1.19]
Training	0.969	[0.93,1.01]	0.946	[0.89,1.00]	0.965	[0.91,1.03]
Good Cause	0.997	[0.96,1.04]	0.997	[0.95,1.04]	1.023	[0.95,1.10]
Suitability	1.010	[0.96,1.06]	1.014	[0.95,1.08]	0.998	[0.93,1.07]
Waiting Periods	0.983	[0.95,1.02]	0.967	[0.93,1.01]	0.979	[0.93,1.03]
Permit to Purchase	0.935*	[0.90,0.97]	0.896*	[0.85,0.94]	1.009	[0.94,1.08]
CBC Only	0.955	[0.91,1.00]	0.953	[0.89,1.02]	0.965	[0.92,1.01]
Parity Law	0.954*	[0.92,0.99]	0.945*	[0.91,0.98]	0.980	[0.95,1.01]
Unemployment Rate	0.998	[0.99,1.00]	0.996	[0.99,1.00]	1.000	[0.99,1.01]
% Poverty	1.002	[1.00,1.01]	1.004	[1.00,1.01]	0.995	[0.99,1.00]
% Male	0.981	[0.91,1.06]	1.041	[0.96,1.13]	0.944	[0.88,1.02]
% Black	0.984	[0.97,1.00]	0.994	[0.97,1.02]	0.968*	[0.95,0.99]
% Married	0.996	[0.99,1.00]	0.997	[0.99,1.00]	0.982*	[0.97,0.99]

% Veteran	1.028*	[1.02,1.04]	1.024*	[1.01,1.03]	1.037*	[1.02,1.05]
% Living in MSA	0.998*	[1.00,1.00]	0.999	[1.00,1.00]	1.001	[1.00,1.00]
Ethanol Consumption per capita	1.104*	[1.04,1.18]	1.156*	[1.07,1.25]	0.962	[0.89,1.04]
% Religious Adherence	1.002	[1.00,1.00]	1.003	[1.00,1.01]	1.003	[1.00,1.01]
% With H.S. Diploma	1.004	[1.00,1.01]	1.005	[1.00,1.01]	1.011*	[1.00,1.02]
% Republican	0.997*	[1.00,1.00]	0.994*	[0.99,1.00]	1.003*	[1.00,1.01]
Addict OD Rate	1.003	[1.00,1.01]	1.002	[1.00,1.01]	1.006*	[1.00,1.01]

Table 8E

Comparative Interrupted Time Series Regression Results: Total Adult Female Population, No OD						
	20up Female Suicide, No OD		20up Female Firearm Suicide		20up Female Nonfirearm Suicide, No OD	
	IRR	95% CI	IRR	95% CI	IRR	95% CI
Shall Issue	1.014	[0.95,1.09]	1.049	[0.92,1.19]	1.091*	[1.01,1.18]
Permitless	1.116	[0.99,1.26]	1.259*	[1.05,1.51]	1.087	[0.94,1.26]
Training	0.956	[0.91,1.01]	0.949	[0.84,1.07]	0.906*	[0.84,0.98]
Good Cause	0.991	[0.92,1.07]	0.935	[0.87,1.00]	1.111	[0.98,1.26]
Suitability	0.974	[0.91,1.04]	1.057	[0.97,1.15]	0.873*	[0.78,0.98]
Waiting Periods	0.957	[0.91,1.01]	0.933	[0.85,1.02]	0.951	[0.86,1.05]
Permit to Purchase	0.939	[0.88,1.00]	0.738*	[0.58,0.95]	1.092	[0.94,1.27]
CBC Only	0.957	[0.89,1.03]	0.900*	[0.82,0.99]	1.023	[0.92,1.14]
Parity Law	0.953	[0.91,1.00]	0.966	[0.90,1.04]	0.945*	[0.89,1.00]
Unemployment Rate	0.998	[0.99,1.00]	0.998	[0.99,1.01]	0.999	[0.99,1.01]
% Poverty	0.999	[0.99,1.01]	1.001	[0.99,1.01]	0.992	[0.98,1.00]
% Male	0.939	[0.84,1.05]	1.086	[0.95,1.24]	0.834*	[0.74,0.94]

% Black	0.970*	[0.94,1.00]	1.006	[0.97,1.05]	0.951*	[0.91,0.99]
% Married	0.997	[0.99,1.01]	1.005	[0.99,1.02]	0.978*	[0.97,0.99]
% Veteran	1.033*	[1.01,1.05]	1.028*	[1.00,1.05]	1.034*	[1.01,1.06]
% Living in MSA	1.000	[1.00,1.00]	0.999	[0.99,1.00]	1.004*	[1.00,1.01]
Ethanol Consumption per capita	1.030	[0.93,1.14]	1.211*	[1.08,1.36]	0.823*	[0.69,0.98]
% Religious Adherence	0.998	[0.99,1.00]	1.002	[1.00,1.01]	0.997	[0.99,1.00]
% With H.S. Diploma	1.004	[0.99,1.01]	1.006	[1.00,1.02]	1.007	[1.00,1.02]
% Republican	0.997*	[0.99,1.00]	0.989*	[0.99,0.99]	1.003	[1.00,1.01]
Addict OD Rate	1.000	[0.99,1.01]	0.999	[0.99,1.01]	0.999	[0.99,1.01]

Table 8F

Comparative Interrupted Time Series Regression Results: Total Adult Male Population, No OD						
	20+ Male Suicide, No OD		20+ Male Firearm Suicide		20+ Male Nonfirearm Suicide, No OD	
	IRR	95% CI	IRR	95% CI	IRR	95% CI
Shall Issue	1.014	[0.97,1.06]	1.063	[1.00,1.14]	1.009	[0.95,1.07]
Permitless	1.101	[0.98,1.23]	1.209*	[1.03,1.42]	0.948	[0.88,1.02]
Training	0.971	[0.94,1.01]	0.940*	[0.89,0.99]	0.994	[0.93,1.06]
Good Cause	0.998	[0.96,1.04]	1.019	[0.97,1.07]	0.975	[0.90,1.05]
Suitability	1.016	[0.96,1.07]	1.001	[0.94,1.07]	1.055	[0.96,1.16]
Waiting Periods	0.988	[0.95,1.02]	0.976	[0.93,1.02]	0.989	[0.94,1.04]
Permit to Purchase	0.936*	[0.90,0.97]	0.924*	[0.88,0.97]	0.964	[0.89,1.04]
CBC Only	0.954	[0.91,1.00]	0.962	[0.90,1.03]	0.950*	[0.92,0.98]
Parity Law	0.953*	[0.92,0.98]	0.947*	[0.91,0.98]	0.971	[0.93,1.01]
Unemployment Rate	0.998	[0.99,1.00]	0.996	[0.99,1.00]	0.998	[0.99,1.00]
% Poverty	1.002	[1.00,1.01]	1.004	[1.00,1.01]	0.997	[0.99,1.00]
% Male	0.970	[0.90,1.04]	1.017	[0.93,1.11]	0.942	[0.89,1.00]

% Black	0.987	[0.97,1.00]	0.992	[0.97,1.01]	0.982*	[0.97,1.00]
% Married	0.995	[0.99,1.00]	0.998	[0.99,1.01]	0.981*	[0.97,0.99]
% Veteran	1.027*	[1.01,1.04]	1.026*	[1.01,1.04]	1.030*	[1.01,1.05]
% Living in MSA	0.998*	[1.00,1.00]	1.000	[1.00,1.00]	0.996*	[0.99,1.00]
Ethanol Consumption per capita	1.119*	[1.05,1.19]	1.177*	[1.09,1.28]	0.965	[0.89,1.05]
% Religious Adherence	1.002	[1.00,1.01]	1.004	[1.00,1.01]	1.002	[1.00,1.01]
% With H.S. Diploma	1.004	[1.00,1.01]	1.002	[1.00,1.01]	1.015*	[1.01,1.02]
% Republican	0.997*	[1.00,1.00]	0.996*	[0.99,1.00]	1.001	[1.00,1.00]
Addict OD Rate	1.003	[1.00,1.01]	1.002	[1.00,1.01]	1.004	[1.00,1.01]

Table 9A

Interaction Results: Total Population, No OD												
	Suicide no OD				Firearm Suicide				Nonfirearm Suicide No OD			
Interaction	IRR	95% CI	IRR	95% CI	IRR	95% CI	IRR	95% CI	IRR	95% CI	IRR	95% CI
	No Training		Training		No Training		Training		No Training		Training	
Not Shall Issue	Ref		0.942	[0.89, 1.00]	Ref		0.892 *	[0.82, 0.97]	Ref		0.952	[0.89, 1.02]
Shall Issue	0.986	[0.95, 1.03]	0.986	[0.95, 1.02]	0.980	[0.92, 1.05]	1.000	[0.96, 1.04]	1.052	[0.95, 1.17]	1.020	[0.98, 1.06]
	Covariates				Covariates				Covariates			
Permitless	1.096 *	[1.00, 1.20]			1.174 *	[1.05, 1.32]			1.106 *	[1.05, 1.17]		
Good Cause	1.002	[0.95, 1.06]			1.007	[0.96, 1.06]			1.025	[0.94, 1.12]		
Suitability	1.013	[0.96, 1.07]			1.014	[0.95, 1.09]			1.004	[0.93, 1.08]		
Waiting Periods	0.985	[0.95, 1.02]			0.966	[0.92, 1.01]			0.980	[0.92, 1.04]		
Permit to Purchase	0.943 *	[0.90, 0.99]			0.911 *	[0.86, 0.96]			1.011	[0.95, 1.08]		
CBC Only	0.954	[0.91, 1.00]			0.958	[0.89, 1.03]			0.962	[0.92, 1.01]		
Parity Law	0.946 *	[0.91, 0.98]			0.931 *	[0.90, 0.97]			0.977	[0.94, 1.01]		
Unemployment Rate	0.996	[0.99, 1.00]			0.993 *	[0.99, 1.00]			0.998	[0.99, 1.00]		
% Poverty	1.001	[1.00, 1.01]			1.003	[1.00, 1.01]			0.995	[0.99, 1.00]		

% Male	0.953	[0.88,1.03]			1.013	[0.93,1.11]			0.923 *	[0.85,1.00]		
% Black	0.984	[0.96,1.00]			0.998	[0.97,1.02]			0.966 *	[0.95,0.98]		
% Married	0.996	[0.99,1.00]			0.997	[0.99,1.00]			0.982 *	[0.97,0.99]		
% Veteran	1.031 *	[1.02,1.04]			1.027 *	[1.02,1.04]			1.038 *	[1.02,1.05]		
% Living in MSA	0.998 *	[1.00,1.00]			0.999	[1.00,1.00]			1.000	[1.00,1.00]		
Ethanol Consumption per capita	1.138 *	[1.06,1.22]			1.182 *	[1.09,1.28]			1.007	[0.93,1.09]		
% Religious Adherence	1.002	[1.00,1.01]			1.004	[1.00,1.01]			1.003	[1.00,1.01]		
% With H.S. Diploma	1.004	[1.00,1.01]			1.005	[1.00,1.01]			1.011 *	[1.00,1.02]		
% Republican	0.997 *	[1.00,1.00]			0.993 *	[0.99,0.99]			1.004 *	[1.00,1.01]		
Addict OD Rate	1.002	[1.00,1.01]			1.001	[1.00,1.01]			1.005 *	[1.00,1.01]		
	Female Suicide no OD				Female Firearm Suicide				Female Nonfirearm Suicide no OD			
Interaction	IRR	95% CI	IRR	95% CI	IRR	95% CI	IRR	95% CI	IRR	95% CI	IRR	95% CI
	No Training		Training		No Training		Training		No Training		Training	
Not Shall Issue	Ref		0.929	[0.85, 1.01]	Ref		0.866 *	[0.75, 1.00]	Ref		0.906	[0.82, 1.00]

Shall Issue	0.973	[0.89, 1.06]	0.973	[0.93, 1.02]	0.941	[0.82, 1.08]	1.003	[0.94, 1.07]	1.111 *	[1.02, 1.21]	1.021	[0.96, 1.08]
	Covariates				Covariates				Covariates			
Permitless	1.105	[0.98, 1.24]			1.210 *	[1.05, 1.39]			1.203 *	[1.05, 1.38]		
Good Cause	1.015	[0.91, 1.13]			0.950	[0.88, 1.02]			1.143	[0.99, 1.32]		
Suitability	0.962	[0.89, 1.03]			1.054	[0.97, 1.14]			0.855 *	[0.75, 0.98]		
Waiting Periods	0.949	[0.89, 1.01]			0.922	[0.85, 1.00]			0.927	[0.84, 1.03]		
Permit to Purchase	0.942	[0.88, 1.01]			0.760 *	[0.62, 0.93]			1.083	[0.95, 1.23]		
CBC Only	0.959	[0.89, 1.03]			0.924	[0.84, 1.01]			1.008	[0.90, 1.12]		
Parity Law	0.943 *	[0.90, 0.99]			0.941	[0.88, 1.01]			0.953	[0.90, 1.01]		
Unemployment Rate	0.995	[0.99, 1.00]			0.993	[0.98, 1.00]			0.998	[0.99, 1.01]		
% Poverty	0.998	[0.99, 1.01]			1.000	[0.99, 1.01]			0.990 *	[0.98, 1.00]		
% Male	0.902	[0.80, 1.01]			1.041	[0.92, 1.18]			0.811 *	[0.70, 0.94]		
% Black	0.974	[0.95, 1.00]			1.017	[0.97, 1.06]			0.947 *	[0.91, 0.99]		
% Married	0.998	[0.99, 1.01]			1.002	[0.99, 1.02]			0.980 *	[0.97, 0.99]		
% Veteran	1.033 *	[1.02, 1.05]			1.032 *	[1.01, 1.06]			1.034 *	[1.01, 1.06]		

% Living in MSA	1.000	[1.00,1.00]			0.998	[0.99,1.00]			1.007 *	[1.00,1.01]		
Ethanol Consumption per capita	1.069	[0.96,1.19]			1.211 *	[1.07,1.37]			0.874	[0.75,1.02]		
% Religious Adherence	0.998	[0.99,1.00]			1.002	[1.00,1.01]			0.999	[0.99,1.01]		
% With H.S. Diploma	1.002	[0.99,1.01]			1.007	[1.00,1.02]			1.007	[0.99,1.02]		
% Republican	0.996 *	[0.99,1.00]			0.988 *	[0.98,0.99]			1.005 *	[1.00,1.01]		
Addict OD Rate	0.999	[0.99,1.01]			0.999	[0.99,1.01]			1.001	[0.99,1.01]		
Male Suicide no OD												
	Male Suicide no OD				Male Firearm Suicide				Male Nonfirearm Suicide no OD			
Interaction	IRR	95% CI	IRR	95% CI	IRR	95% CI	IRR	95% CI	IRR	95% CI	IRR	95% CI
	No Training		Training		No Training		Training		No Training		Training	
Not Shall Issue	Ref		0.944 *	[0.89, 1.00]	Ref		0.895 *	[0.83, 0.96]	Ref		0.964	[0.91, 1.03]
Shall Issue	0.990	[0.94, 1.03]	0.990	[0.96, 1.02]	0.994	[0.94, 1.05]	1.004	[0.97, 1.04]	1.030	[0.91, 1.16]	1.019	[0.98, 1.06]
	Covariates				Covariates				Covariates			
Permitless	1.093 *	[1.00,1.19]			1.170 *	[1.05,1.31]			1.079 *	[1.03,1.13]		
Good Cause	1.000	[0.96,1.05]			1.015	[0.97,1.07]			0.997	[0.92,1.08]		
Suitability	1.023	[0.97,1.08]			1.010	[0.94,1.08]			1.046	[0.97,1.13]		

Waiting Periods	0.993	[0.96,1.03]
Permit to Purchase	0.944 *	[0.91,0.98]
CBC Only	0.952	[0.90,1.00]
Parity Law	0.946 *	[0.91,0.98]
Unemployment Rate	0.996	[0.99,1.00]
% Poverty	1.002	[1.00,1.01]
% Male	0.950	[0.89,1.02]
% Black	0.986	[0.97,1.00]
% Married	0.995	[0.99,1.00]
% Veteran	1.030 *	[1.02,1.04]
% Living in MSA	0.997 *	[1.00,1.00]
Ethanol Consumption per capita	1.153 *	[1.08,1.24]
% Religious Adherence	1.003	[1.00,1.01]
% With H.S. Diploma	1.005	[1.00,1.01]

0.973	[0.93,1.02]
0.930 *	[0.87,0.99]
0.963	[0.90,1.03]
0.928 *	[0.90,0.96]
0.993 *	[0.99,1.00]
1.003	[1.00,1.01]
0.992	[0.91,1.08]
0.996	[0.97,1.02]
0.995	[0.99,1.00]
1.027 *	[1.01,1.04]
0.999	[1.00,1.00]
1.182 *	[1.09,1.28]
1.004 *	[1.00,1.01]
1.005	[1.00,1.01]

0.995	[0.94,1.05]
0.992	[0.93,1.06]
0.953 *	[0.92,0.99]
0.984	[0.95,1.02]
0.999	[0.99,1.00]
0.997	[0.99,1.00]
0.944	[0.88,1.01]
0.973 *	[0.96,0.99]
0.982 *	[0.97,0.99]
1.038 *	[1.02,1.05]
0.999	[1.00,1.00]
1.049	[0.97,1.14]
1.004 *	[1.00,1.01]
1.012 *	[1.00,1.02]

% Republican	0.997 *	[1.00,1.00]	0.994 *	[0.99,1.00]	1.003 *	[1.00,1.01]
Addict OD Rate	1.003	[1.00,1.01]	1.001	[1.00,1.01]	1.006 *	[1.00,1.01]

Table 9B

Interaction Results: Adult Population, No OD												
	20 + Suicide No OD				20 + Firearm Suicide				20 + Nonfirearm Suicide No OD			
Interaction	IRR	95% CI	IRR	95% CI	IRR	95% CI	IRR	95% CI	IRR	95% CI	IRR	95% CI
	No Training		Training		No Training		Training		No Training		Training	
Not Shall Issue	Ref		0.946	[0.89, 1.00]	Ref		0.899 *	[0.83, 0.97]	Ref		0.961	[0.90, 1.02]
Shall Issue	0.980	[0.94, 1.02]	0.987	[0.95, 1.02]	0.979	[0.91, 1.05]	1.003	[0.96, 1.04]	1.042	[0.93, 1.17]	1.013	[0.98, 1.05]
	Covariates				Covariates				Covariates			
Permitless	1.105	[0.99, 1.23]			1.181 *	[1.03, 1.35]			1.104 *	[1.03, 1.19]		
Good Cause	0.998	[0.96, 1.04]			1.000	[0.96, 1.04]			1.024	[0.95, 1.10]		
Suitability	1.012	[0.96, 1.06]			1.018	[0.95, 1.09]			0.999	[0.93, 1.07]		
Waiting Periods	0.980	[0.95, 1.01]			0.961	[0.92, 1.01]			0.978	[0.92, 1.03]		
Permit to Purchase	0.944 *	[0.90, 0.99]			0.914 *	[0.87, 0.96]			1.011	[0.95, 1.08]		
CBC Only	0.958	[0.92, 1.00]			0.961	[0.90, 1.02]			0.966	[0.92, 1.01]		

Parity Law	0.952 *	[0.92,0.98]	0.941 *	[0.91,0.97]	0.980	[0.94,1.02]
Unemployment Rate	0.998	[0.99,1.00]	0.996	[0.99,1.00]	1.000	[0.99,1.01]
% Poverty	1.001	[1.00,1.01]	1.003	[1.00,1.01]	0.995	[0.99,1.00]
% Male	0.978	[0.91,1.05]	1.035	[0.95,1.12]	0.944	[0.87,1.02]
% Black	0.987	[0.97,1.01]	1.001	[0.98,1.03]	0.969 *	[0.95,0.99]
% Married	0.997	[0.99,1.00]	0.998	[0.99,1.01]	0.982 *	[0.97,0.99]
% Veteran	1.029 *	[1.02,1.04]	1.025 *	[1.01,1.04]	1.037 *	[1.02,1.05]
% Living in MSA	0.998 *	[1.00,1.00]	0.999	[1.00,1.00]	1.001	[1.00,1.00]
Ethanol Consumption per capita	1.108 *	[1.04,1.18]	1.165 *	[1.08,1.25]	0.963	[0.89,1.04]
% Religious Adherence	1.002	[1.00,1.01]	1.003	[1.00,1.01]	1.003	[1.00,1.01]
% With H.S. Diploma	1.004	[1.00,1.01]	1.004	[1.00,1.01]	1.011 *	[1.00,1.02]
% Republican	0.997 *	[1.00,1.00]	0.994 *	[0.99,1.00]	1.003 *	[1.00,1.01]
Addict OD Rate	1.002	[1.00,1.01]	1.001	[1.00,1.01]	1.006 *	[1.00,1.01]

	20 + Female Suicide No OD				20 + Female Firearm Suicide				20 + Female Nonfirearm Suicide No OD			
Interaction	IRR	95% CI	IRR	95% CI	IRR	95% CI	IRR	95% CI	IRR	95% CI	IRR	95% CI
	No Training		Training		No Training		Training		No Training		Training	
Not Shall Issue	Ref		0.93 2	[0.86, 1.01]	Ref		0.876	[0.76, 1.01]	Ref		0.907 *	0.83, 1.00]
Shall Issue	0.977	[0.91, 1.05]	0.97 3	[0.93, 1.02]	0.935	[0.81, 1.08]	1.007	[0.94, 1.08]	1.094 *	[1.00, 1.19]	0.988	[0.93, 1.05]
	Covariates				Covariates				Covariates			
Permitless	1.119	[0.99,1.2 7]			1.270 *	[1.06,1.5 2]			1.086	[0.94,1.2 6]		
Good Cause	0.993	[0.92,1.0 7]			0.940	[0.88,1.0 0]			1.111	[0.98,1.2 6]		
Suitability	0.976	[0.91,1.0 4]			1.062	[0.98,1.1 5]			0.873 *	[0.77,0.9 8]		
Waiting Periods	0.953	[0.91,1.0 0]			0.924	[0.85,1.0 1]			0.951	[0.86,1.0 5]		
Permit to Purchase	0.948	[0.88,1.0 2]			0.763 *	[0.61,0.9 5]			1.091	[0.94,1.2 7]		
CBC Only	0.961	[0.89,1.0 4]			0.911	[0.83,1.0 0]			1.023	[0.92,1.1 4]		
Parity Law	0.951 *	[0.91,1.0 0]			0.959	[0.90,1.0 3]			0.945 *	[0.89,1.0 0]		
Unemployment Rate	0.998	[0.99,1.0 0]			0.998	[0.99,1.0 1]			0.999	[0.99,1.0 1]		
% Poverty	0.998	[0.99,1.0 1]			1.001	[0.99,1.0 1]			0.992	[0.98,1.0 0]		

% Male	0.936	[0.84,1.04]			1.077	[0.94,1.23]			0.834 *	[0.74,0.94]		
% Black	0.973	[0.95,1.00]			1.017	[0.98,1.06]			0.951 *	[0.91,0.99]		
% Married	0.997	[0.99,1.01]			1.006	[0.99,1.02]			0.978 *	[0.97,0.99]		
% Veteran	1.034 *	[1.01,1.05]			1.031 *	[1.00,1.06]			1.034 *	[1.01,1.06]		
% Living in MSA	1.000	[1.00,1.00]			0.999	[0.99,1.00]			1.004 *	[1.00,1.01]		
Ethanol Consumption per capita	1.034	[0.93,1.15]			1.224 *	[1.09,1.38]			0.823 *	[0.69,0.98]		
% Religious Adherence	0.998	[0.99,1.00]			1.002	[1.00,1.01]			0.997	[0.99,1.00]		
% With H.S. Diploma	1.003	[0.99,1.01]			1.005	[1.00,1.02]			1.007	[1.00,1.02]		
% Republican	0.997 *	[0.99,1.00]			0.989 *	[0.99,0.99]			1.003	[1.00,1.01]		
Addict OD Rate	1.000	[0.99,1.01]			0.998	[0.99,1.01]			0.999	[0.99,1.01]		
	20 + Male Suicide No OD				20 + Male Firearm Suicide				20 + Male Nonfirearm Suicide No OD			
Interaction	IRR	95% CI	IRR	95% CI	IRR	95% CI	IRR	95% CI	IRR	95% CI	IRR	95% CI
	No Training		Training		No Training		Training		No Training		Training	
Not Shall Issue	Ref		0.949	[0.90, 1.00]	Ref		0.89*	[0.83, 0.96]	Ref		0.991	[0.94, 1.05]

Shall Issue	0.981	[0.94, 1.03]	0.988	[0.96, 1.02]	0.991	[0.93, 1.05]	1.006	[0.97, 1.05]	1.006	[0.90, 1.13]	1.003	[0.97, 1.04]
	Covariates				Covariates				Covariates			
Permitless	1.103	[0.98, 1.23]			1.214 *	[1.04, 1.42]			0.948	[0.88, 1.02]		
Good Cause	1.000	[0.96, 1.04]			1.022	[0.98, 1.07]			0.975	[0.90, 1.05]		
Suitability	1.018	[0.96, 1.08]			1.004	[0.94, 1.08]			1.055	[0.96, 1.16]		
Waiting Periods	0.985	[0.95, 1.02]			0.970	[0.92, 1.02]			0.989	[0.93, 1.05]		
Permit to Purchase	0.945 *	[0.90, 0.99]			0.941	[0.88, 1.00]			0.965	[0.90, 1.03]		
CBC Only	0.957	[0.91, 1.00]			0.969	[0.91, 1.03]			0.950 *	[0.92, 0.98]		
Parity Law	0.951 *	[0.92, 0.98]			0.943 *	[0.91, 0.98]			0.971	[0.93, 1.01]		
Unemployment Rate	0.998	[0.99, 1.00]			0.997	[0.99, 1.00]			0.998	[0.99, 1.00]		
% Poverty	1.002	[1.00, 1.01]			1.004	[1.00, 1.01]			0.997	[0.99, 1.00]		
% Male	0.967	[0.90, 1.04]			1.012	[0.93, 1.10]			0.942	[0.89, 1.00]		
% Black	0.990	[0.97, 1.01]			0.999	[0.98, 1.02]			0.982 *	[0.97, 1.00]		
% Married	0.996	[0.99, 1.00]			0.999	[0.99, 1.01]			0.981 *	[0.97, 0.99]		
% Veteran	1.028 *	[1.02, 1.04]			1.027 *	[1.02, 1.04]			1.030 *	[1.01, 1.05]		

% Living in MSA	0.998 *	[1.00,1.00]	1.000	[1.00,1.00]	0.996 *	[0.99,1.00]
Ethanol Consumption per capita	1.123 *	[1.06,1.19]	1.186 *	[1.10,1.28]	0.965	[0.89,1.05]
% Religious Adherence	1.003	[1.00,1.01]	1.004 *	[1.00,1.01]	1.002	[1.00,1.01]
% With H.S. Diploma	1.004	[1.00,1.01]	1.002	[1.00,1.01]	1.015 *	[1.01,1.02]
% Republican	0.997 *	[1.00,1.00]	0.996 *	[0.99,1.00]	1.001	[1.00,1.00]
Addict OD Rate	1.003	[1.00,1.01]	1.002	[1.00,1.01]	1.004	[1.00,1.01]

Table 10

Synthetic Control Results: Training Laws, States with MSPE < 1					
State	Adult Male Firearm Suicide				
	MSPE	Change (%)	p20	p5	p2
California	0.226	-17.92	1/14 (0.07)	1/12 (0.08)	1/9 (0.11)
Colorado	0.997	10.55	0/13 (0)	0/12 (0)	0/12 (0)
Connecticut	0.317	-5.85	5/17 (0.29)	4/13 (0.31)	3/9 (0.33)
Florida	0.0717	-5.19	7/25 (0.28)	6/21 (0.29)	4/3 (0.31)
Hawaii	0.858	-10.45	6/17 (0.35)	6/16 (0.38)	5/13 (0.38)
Iowa	0.428	1.68	6/11 (0.55)	4/9 (0.44)	3/5 (0.60)
Maine	0.305	3.69	7/23 (0.30)	7/23 (0.30)	6/18 (0.33)
Michigan	0.030	8.37	1/3 (0.33)	0/0 (0)	0/0 (0)
North Carolina	0.570	5.59	5/17 (0.29)	4/16 (0.25)	3/13 (0.23)
North Dakota	0.181	3.56	12/27 (0.44)	11/26 (0.42)	8/21 (0.38)
Ohio	0.591	9.12	4/8 (0.5)	2/4 (0.5)	0/1 (0)
Oregon	0.184	7.96	3/23 (0.13)	3/18 (0.17)	2/16 (0.125)
Tennessee	0.107	3.38	7/23 (0.30)	6/18 (0.30)	5/15 (0.33)
Texas	0.358	-15.45	0/17 (0)	0/13 (0)	0/11 (0)
Utah	0.196	0.818	13/27 (0.48)	12/26 (0.46)	10/22 (0.45)
Virginia	0.420	-2.93	4/10 (0.40)	3/6 (0.50)	3/6 (0.50)
Wisconsin	0.257	-2.52	4/9 (0.44)	3/7 (0.43)	1/4 (0.25)

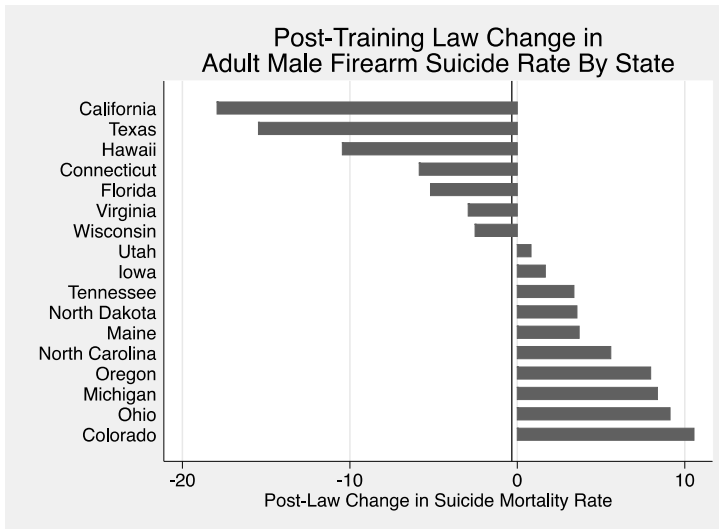


Fig 4

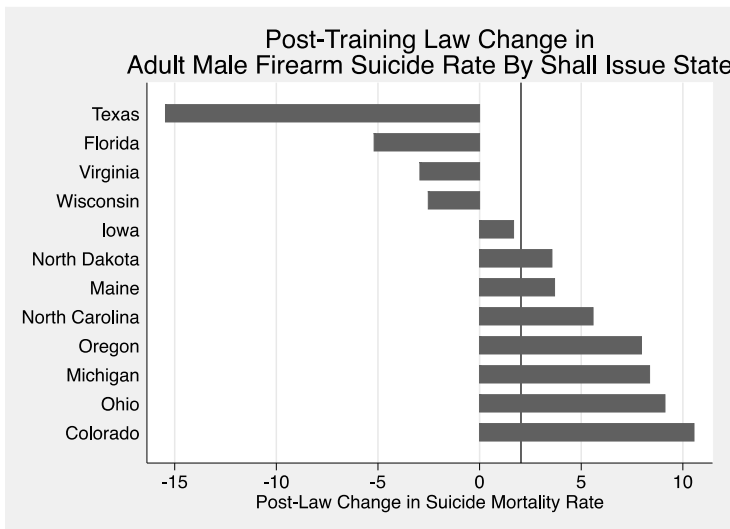


Fig 5

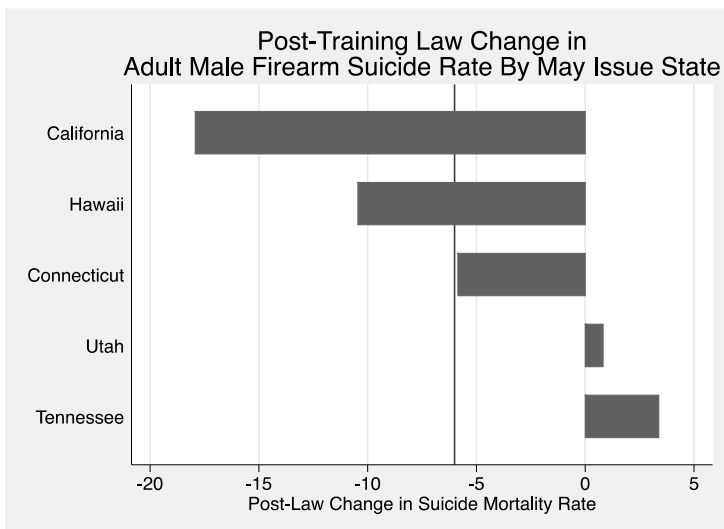
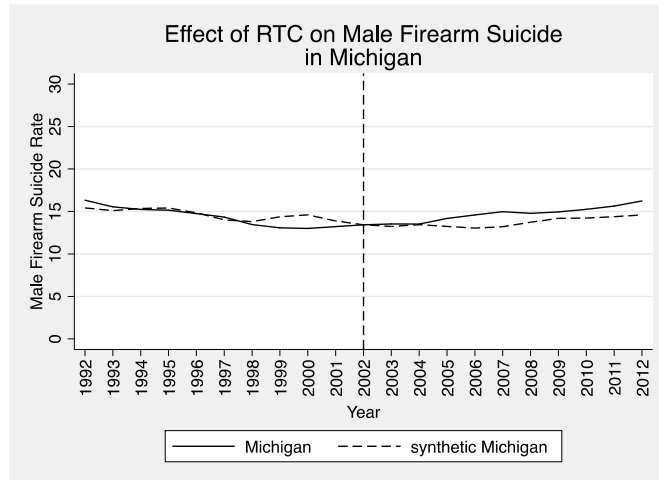
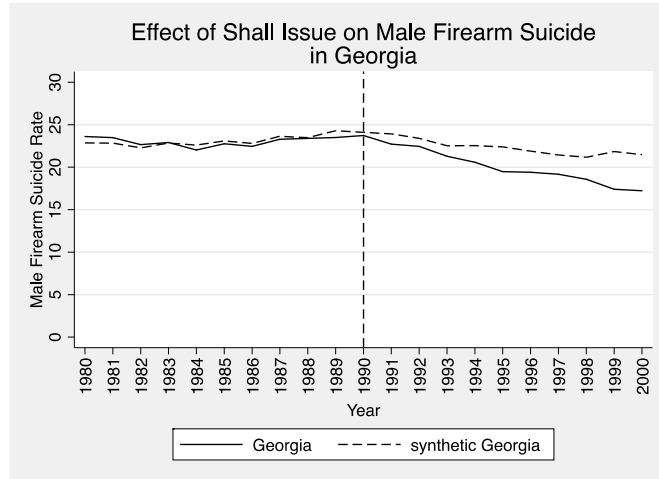
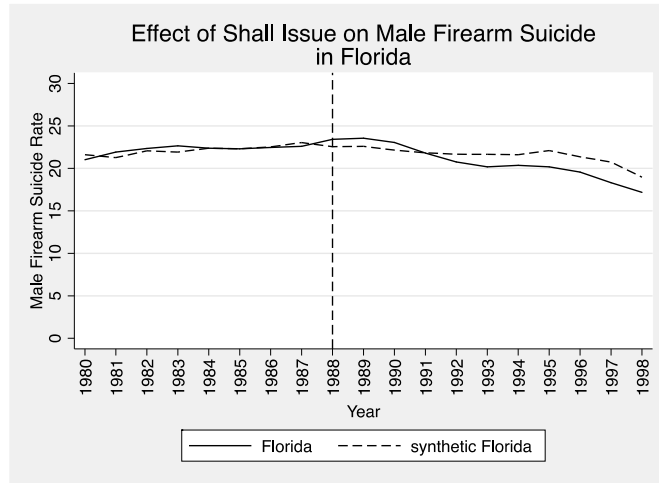
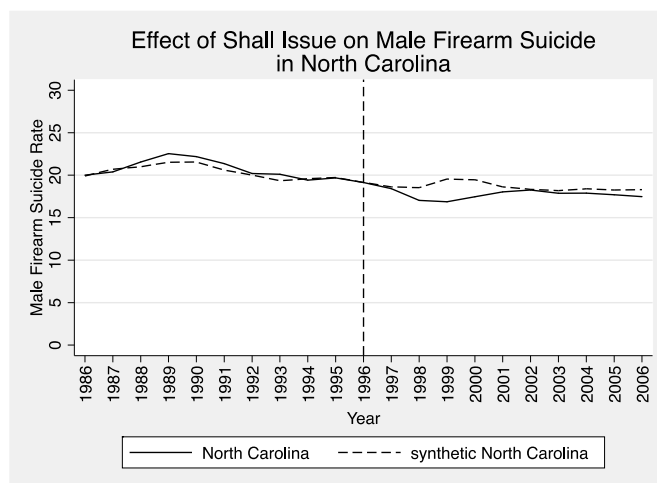
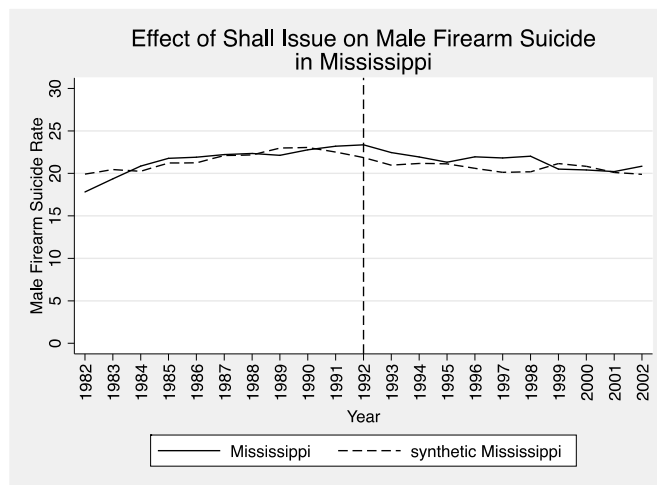
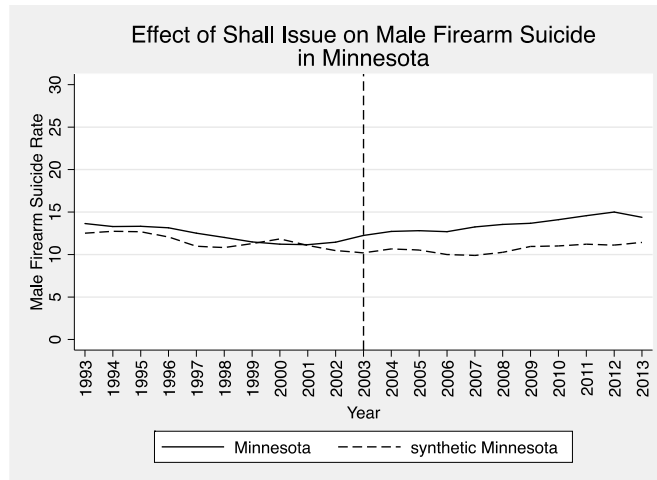
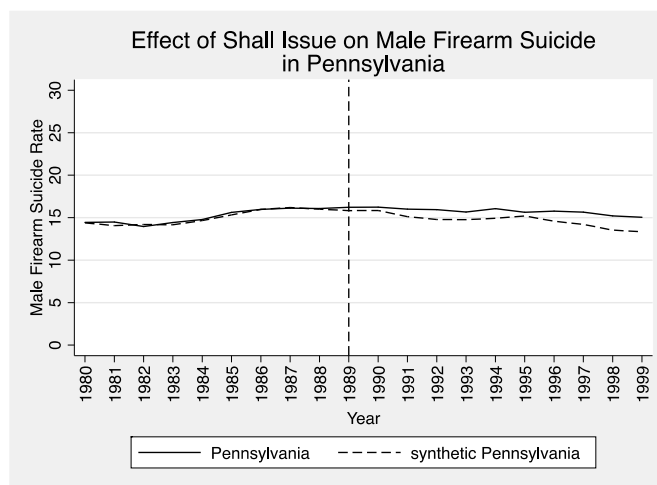
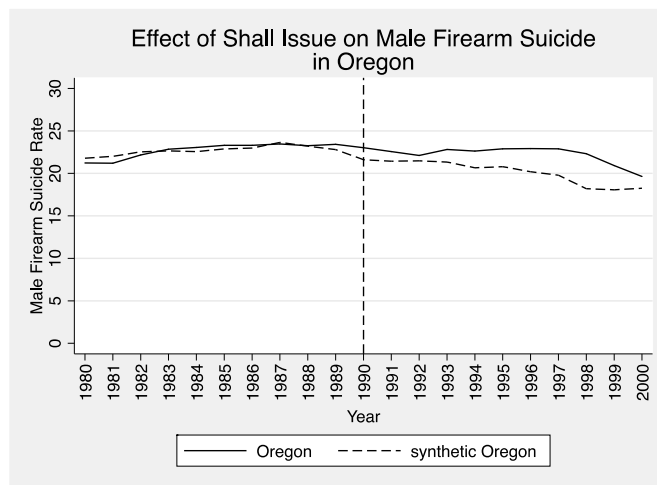
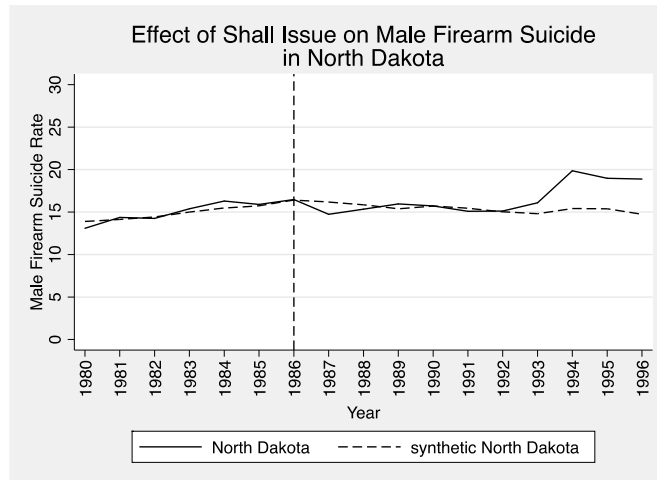


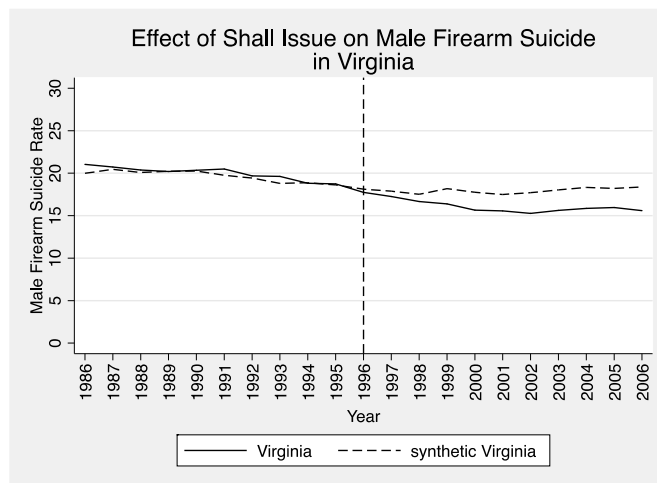
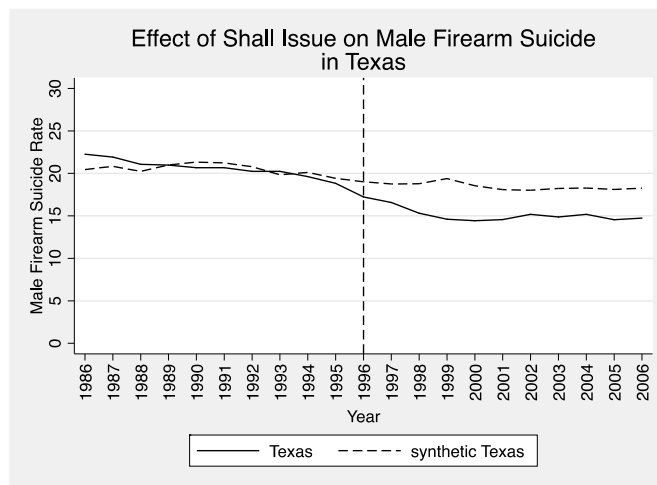
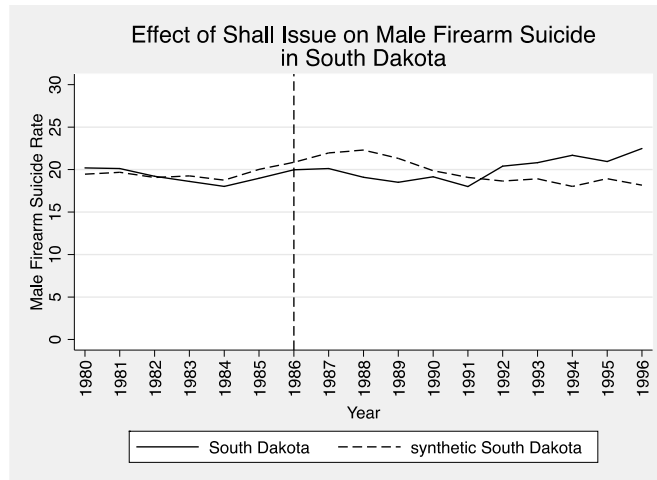
Fig 6

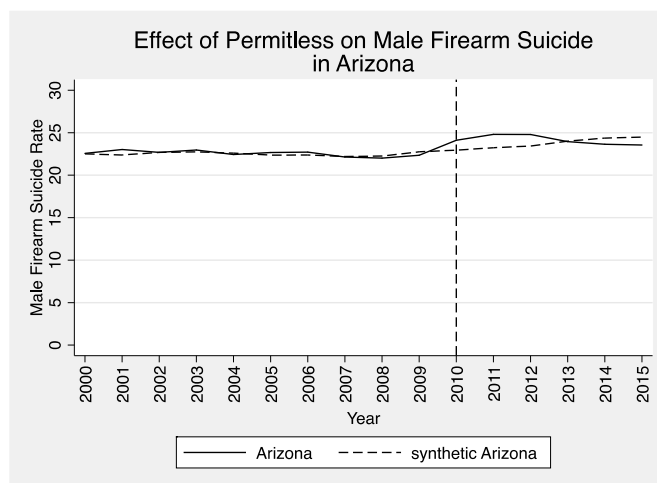
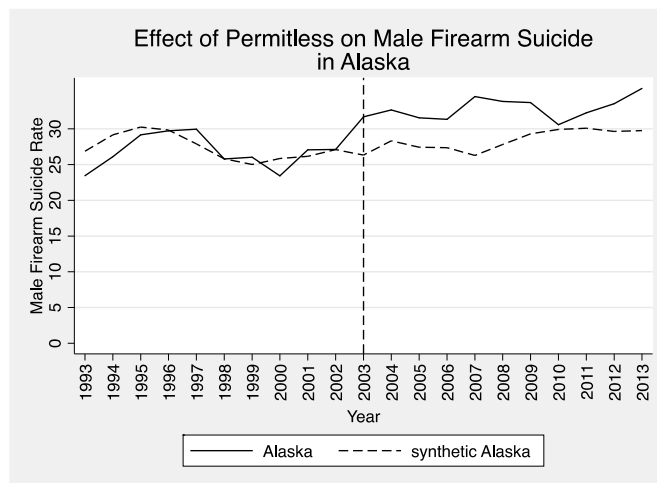
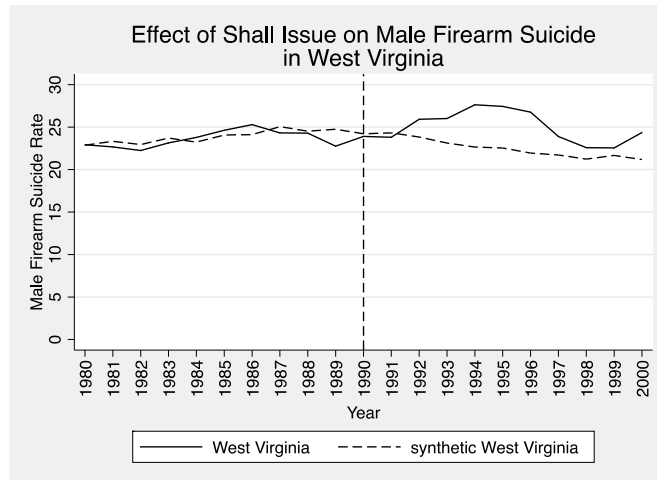
APPENDIX: SYNTHETIC CONTROL GRAPHS

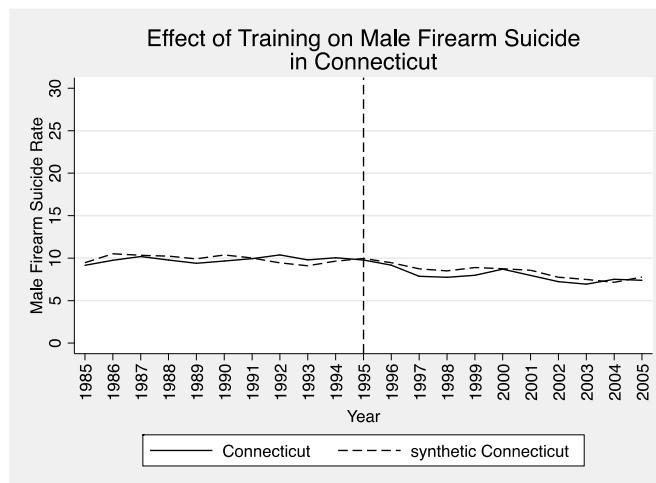
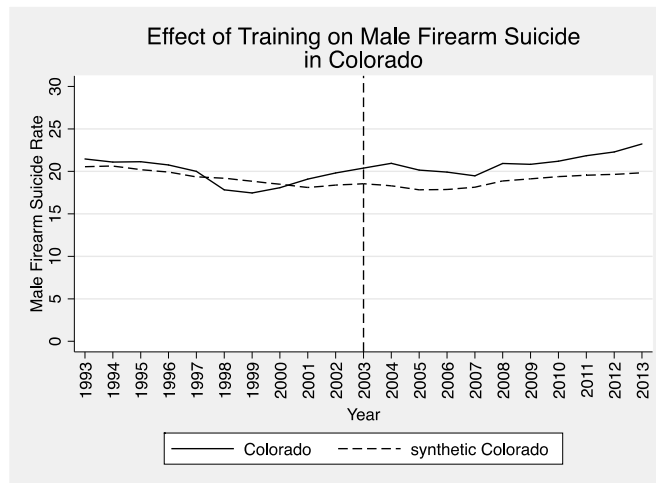
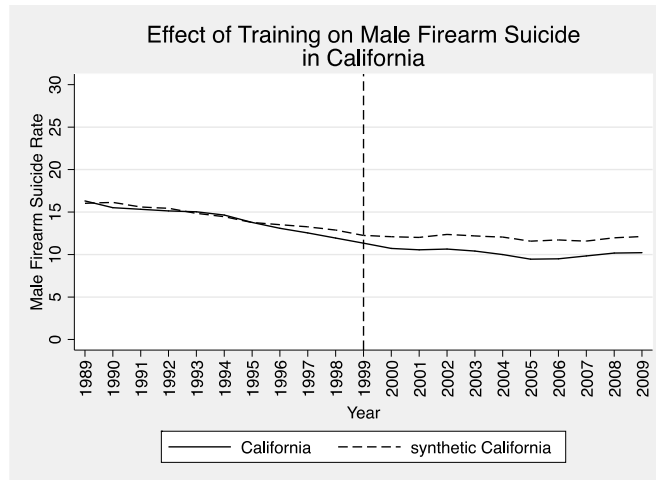


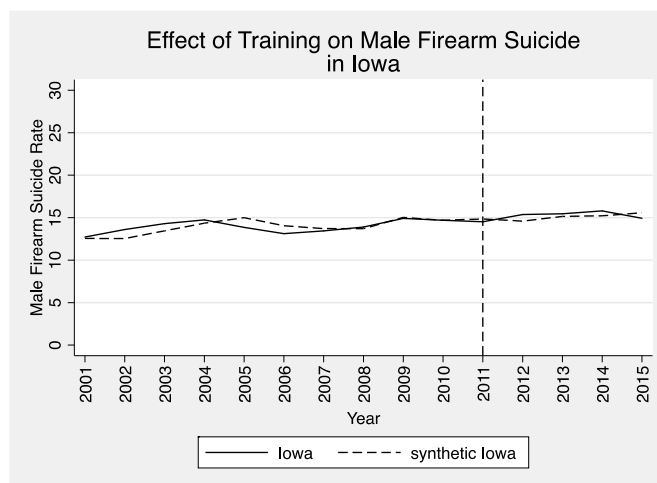
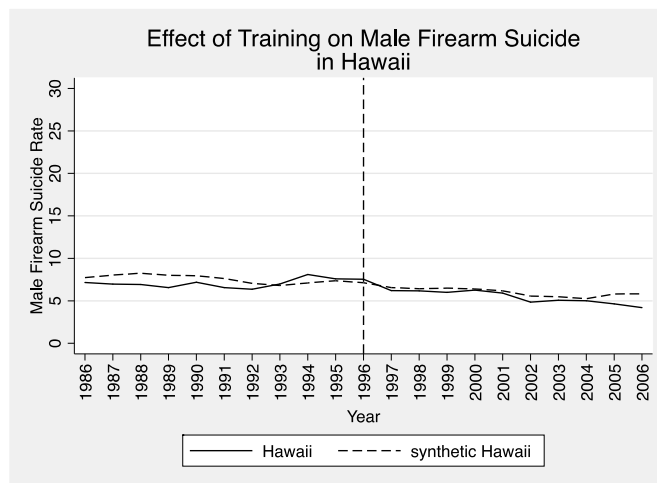
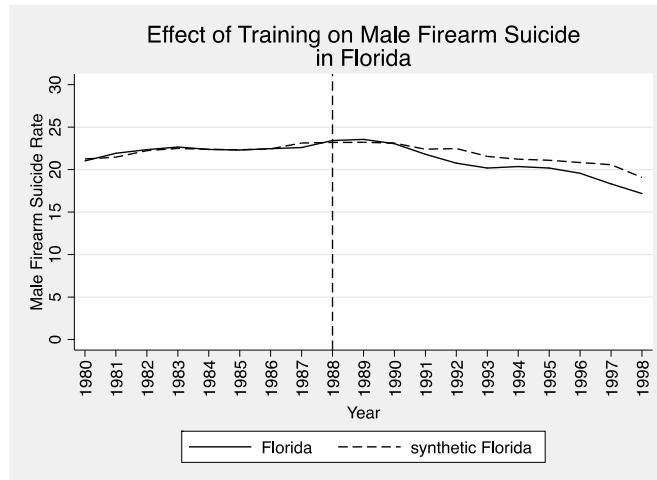


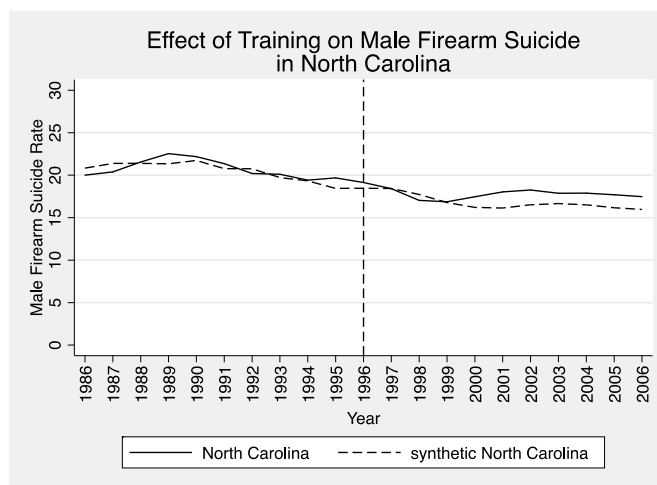
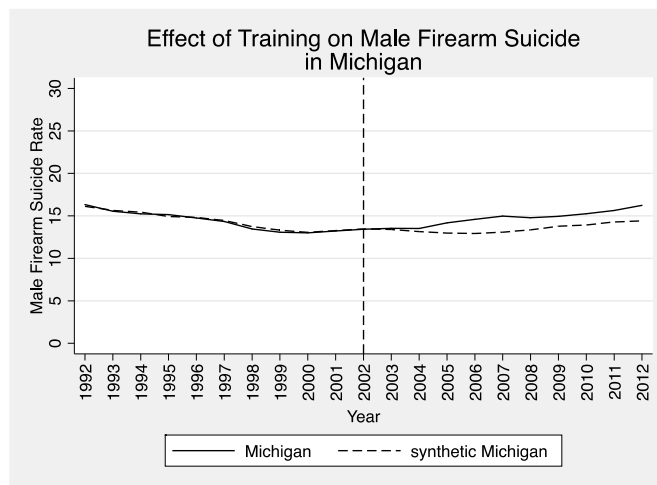
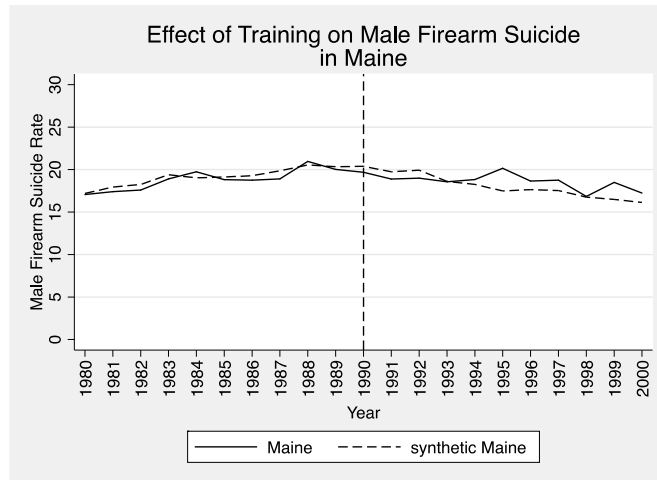


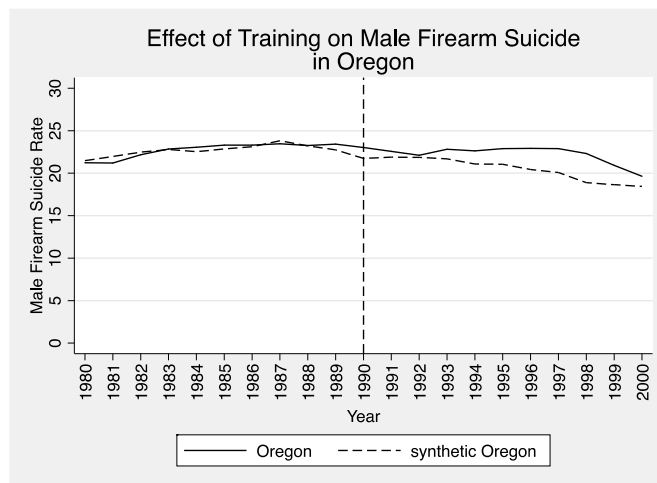
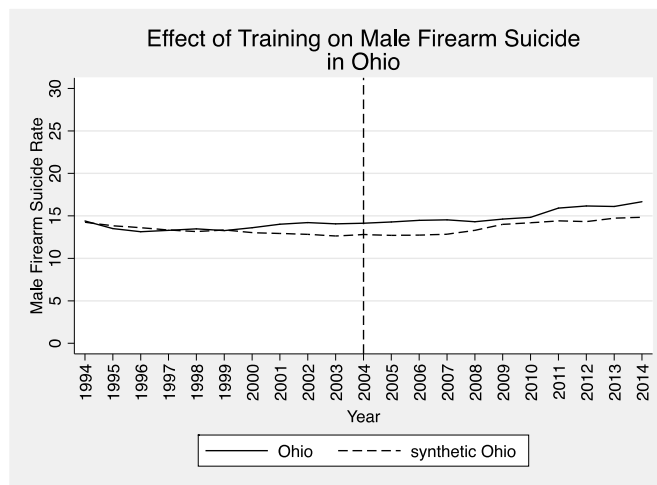
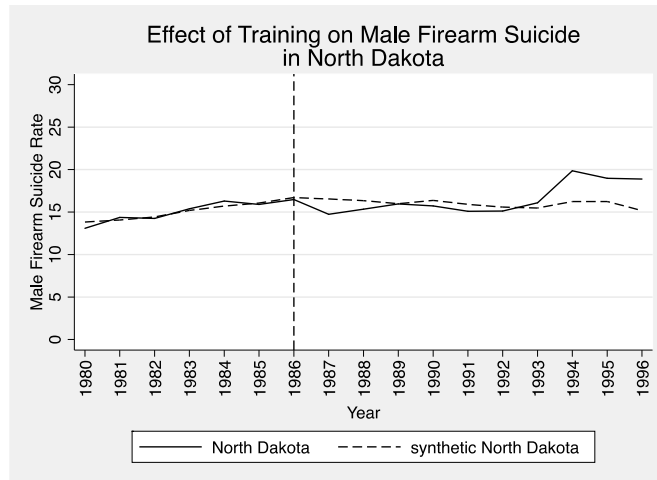


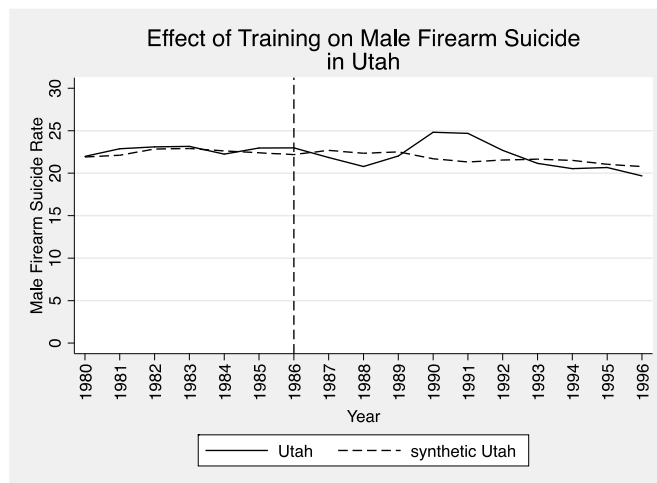
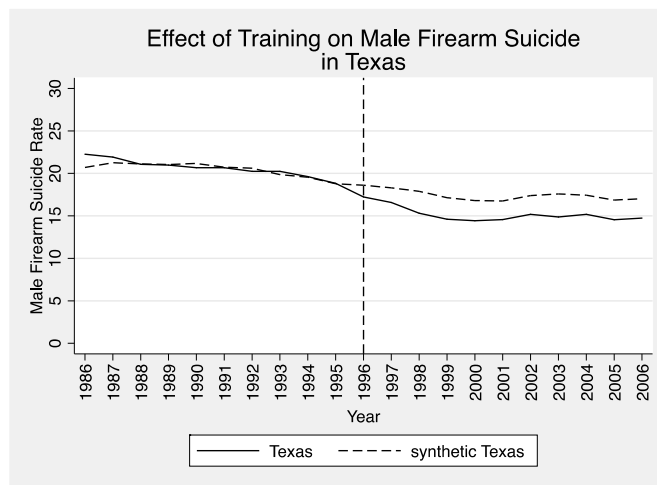
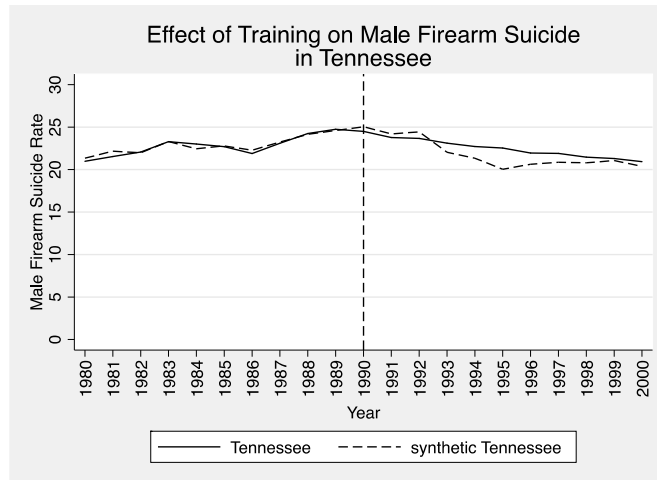


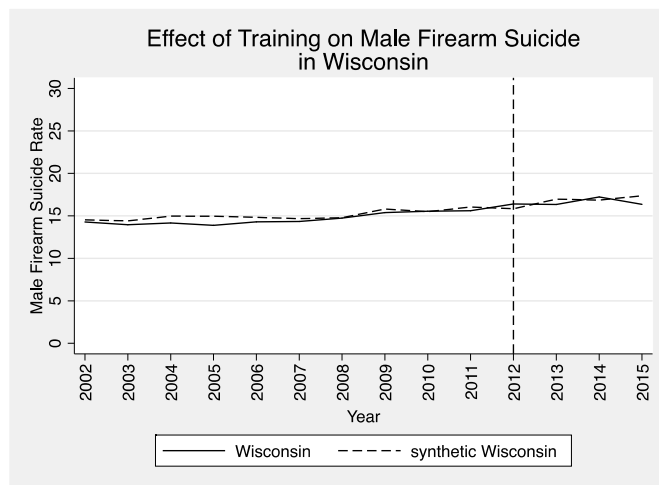
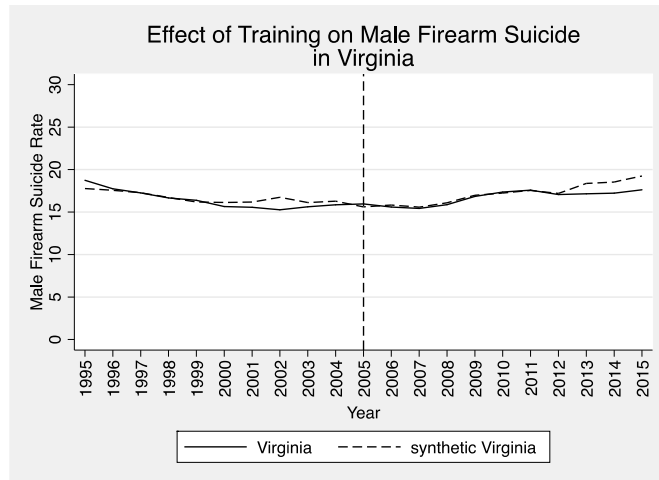












CURRICULUM VITAE

Alexander Duncan McCourt

PERSONAL DATA

1500 Union Avenue
APT 202
Baltimore, MD 21211
(520) 591-0765
amccour1@jhu.edu

Born February 4, 1988, Tucson, AZ

EDUCATION AND TRAINING

PhD Candidate in Health and Public Policy, in progress	Johns Hopkins University, Johns Hopkins Bloomberg School of Public Health, Department of Health Policy and Management
Juris Doctor, <i>magna cum laude</i> , 2014	University of Arizona James E. Rogers College of Law
Master of Public Health–Epidemiology, 2014	University of Arizona, Mel and Enid Zuckerman College of Public Health
Bachelor of Science in Health Sciences/Physiology with Honors, <i>magna cum laude</i> , 2010	University of Arizona
<u>Bar Admissions</u> State of Maryland, 2014	

PROFESSIONAL EXPERIENCE

Center for Gun Policy and Research, Johns Hopkins Bloomberg School of Public Health

Baltimore, MD

Research Assistant (May 2015–Present)

Supervisors: Daniel Webster, ScD, MPH; Jon Vernick, JD, MPH

Legal research, statistical analysis, data collection, dataset building, and contribution to study design for a series of studies evaluating different aspects of gun violence and gun policy.

Lainie Rutkow, JD, PhD, MPH, Associate Professor, Johns Hopkins Bloomberg School of Public Health

Baltimore, MD

Research Assistant (January 2016–Present)

Legal research, coding, and study design assistance for collaborative study with the Centers for Disease Control and Prevention.

Institute for Global Tobacco Control, Johns Hopkins Bloomberg School of Public Health

Baltimore, MD

Legal Research Assistant (January 2016–February 2016)

Researched and summarized foreign tobacco pack labeling laws for 14 countries as part of a Tobacco Pack Surveillance System.

Professor David Marcus, University of Arizona, James E. Rogers College of Law, Tucson, AZ

Research Assistant (January 2014–May 2014)

Researched and edited citations for a Pretrial Litigation textbook.

Office of the General Counsel – University of Arizona, Tucson, AZ

Law Clerk (May 2013–May 2014)

Researched and wrote memoranda about a variety of topics relating to the University of Arizona, including state trust lands, American Disability Act, workplace violence, and the Establishment Clause.

Professor Ellen Bublick, University of Arizona, James E. Rogers College of Law, Tucson, AZ

Research Assistant (Fall 2012)

Researched statutory and case law to help prepare an expert report for use in an implied indemnity case.

Tucson Family Advocacy Program, A Medical–Legal Partnership Tucson, AZ

Legal Intern (Summer 2012)

Performed analysis of case files, intake interviews, case research, and document drafting for cases dealing primarily with low income and refugee clients in a Family Medicine Clinic. Research focused on legal issues affecting patient health, including access to health care, disability benefits, naturalization, and medical powers of attorney.

University of Arizona Department of Neurology, Tucson, AZ

Lab Manager, Student Researcher, and Clinical Assistant (July 2007–August 2011)

Coordinated and managed lab protocols, performed and designed experiments, and managed data analysis. Administered oral tests to patients and programmed Deep Brain Stimulator Therapy Devices in a Parkinson's disease clinic.

PROFESSIONAL ACTIVITIES

Society Membership

American Public Health Association, Law Section, Injury Control and Emergency Health Services Section (2014–present)

Maryland State Bar Association (2014–present)

American Bar Association (2014–present)

EDITORIAL ACTIVITIES

Peer Review Activities

American Journal of Public Health (2018)

Editorial Board Membership

Senior Managing Editor, Arizona Law Review (2013–2014)

Syllabus Manager, Arizona Law Review (2012–2013)

HONORS AND AWARDS

John C. Hume Doctoral Award (2018)

Johns Hopkins Center for Gun Policy and Research Dissertation Award (2017–2018)

John Paul Stapp Endowed Scholarship (2016)

Nancy A. Robertson Scholarship in Injury Prevention (2014–2016)

Junius Hoffman “Beyond the JD” Award (2014)

Step toe & Johnson Editor of the Year (2014)

Step toe & Johnson 2L Writer of the Year (2013)

Sherman & Howard, L.L.C. Scholarship (2012–2013)

CALI Award for Excellent Achievement in Introduction to Legal and Civil Procedure (2012)

Outstanding Performance in Legal Writing (2012)

Outstanding Performance in Oral Argument (2012)

PUBLICATIONS AND RESEARCH

Journal Articles

Crifasi CK, Merrill-Francis M, **McCourt A**, Vernick JS, Wintemute GJ, Webster DW. Association between firearm laws and homicide in urban counties. *J Urban Health* 2018;95(3):383–90. <https://doi.org/10.1007/s11524-018-0273-3>.

Betz ME, **McCourt AD**, Vernick JS, Ranney ML, Maust DT, Wintemute GJ. Firearms and dementia: clinical considerations. *Ann Intern Med*. 2018;169(1):47–49. doi: 10.7326/M18-0140.

McCourt AD, Vernick JS. Law, ethics, and conversations between physicians and patients about firearms in the home. *AMA Journal of Ethics*. 2018;20(1):69–76. doi: 10.1001/journalofethics.2018.20.1.hlaw1-1801.

Zeoli AM, **McCourt A**, Buggs S, Frattaroli S, Lilley S, and Webster DW. Analysis of the strength of legal firearms restrictions for perpetrators of domestic violence and their association with intimate partner homicide. *Am J of Epidemiol*. 2017;187(7):1449–55. <https://doi.org/10.1093/aje/kwx362>.

McCourt AD, Vernick JS, Betz ME, Brandspiegel S, Runyan CW. Temporary transfer of firearms from the home to prevent suicide: legal obstacles and recommendations. *JAMA Intern Med*. 2017;177(1):96-101. doi: 10.1001/jamainternmed.2016.5704.

Falk T, Yue X, Zhang S, **McCourt AD**, Yee B, Gonzalez R, Sherman SJ. Vascular endothelial growth factor-B is neuroprotective in an in vivo rat model of Parkinson's disease. *Neurosci. Lett*. 2011;496(1):43–47.

Falk T, Congrove NR, Zhang S, **McCourt AD**, Sherman SJ, McKay BS. PEDF and VEGF-A output from human retinal pigment epithelial cells grown on novel microcarriers. *J. Biomed Biotechnol*. 2012;2012: 278932. doi: 10.1155/2012/278932.

Letters

Stuart EA, Crifasi C, **McCourt A**, Vernick JS, Webster D. Differing perspectives on analyzing data related to firearms and suicide. *Am J Public Health*. 2017;107(8):e26. doi: 10.2105/AJPH.2017.303890.

Reports

Webster DW, Crifasi CK, Vernick JS, **McCourt A**. Concealed carry of firearms: facts vs. fiction. Center for Gun Policy and Research. Johns Hopkins Bloomberg School of Public Health. November 16, 2017.

Other Publications

McCourt A, *Rae Ann Rumery, John Skarhus, and Cartwright Elementary School District v. Maria Baier*, No. CV-11-0358-PR, 2013 WL 85338 (Ariz. 2013), Ariz. L. Rev. Syl. (2013).

Dissertation

Concealed Carry of Firearms in the United States: A Public Health Law Analysis of State Policy and State Suicide Mortality. PhD Dissertation. [in progress]

PRACTICE ACTIVITIES

Testimony

Testimony in support of SB 860 and HB 1031—Public Safety—Regulated Firearms—Transfer. Maryland Senate and House of Delegates, February—March 2018.

CURRICULUM VITAE

Alexander Duncan McCourt

Part II

TEACHING

Classroom Instruction

Teaching Assistant: Public Health and the Law (2017)
Health Advocacy (2016–2018)
Understanding and Preventing Violence (2016–2017)
Graduate Seminar in Injury and Research Policy (2016)
Fundamentals of Health Policy & Management (2016)
Formulating Policy: Strategies and Systems of Policymaking in the 21st Century (2015)

Teaching Fellowship: Supreme Court Teaching Fellow (2014)

Invited Lectures: *State Firearm Laws and Suicide: Implications of transfer and public carrying policies*. Department of Mental Health Seminar, Johns Hopkins Bloomberg School of Public Health. October 18, 2017.

Legal Gun Carrying in Public Places: Impacts on Violence and Implications for Policy (with Webster DW). The Johns Hopkins

PRESENTATIONS

Scientific Meetings

McCourt A, Rutkow L, Sunshine G. An Analysis of Litigation Arising from Emergency Preparedness and Response Activities in the United States. Poster presentation at the annual meeting of the American Public Health Association, Atlanta, GA, November 2017.

Edwards D, **McCourt A**, Shulman J. An innovative approach to reduce drunk-driving injuries and deaths: using the threat of litigation to encourage rental car companies to install technology to prevent drunk driving. Poster presentation at the annual meeting of the American Public Health Association, Chicago, IL, November 2015.

Invited Presentations

McCourt A. Concealed Carry and Suicide: Evaluating the Effect of Exposure to Firearms on State Suicide Rates. Suicide Research Meeting. Baltimore, MD. July 6, 2018.

Rutkow L, **McCourt A**, Sunshine G. Litigation arising from emergency preparedness and response activities in the U.S.: preliminary findings. Public Health Law Program, Centers for Disease Control and Prevention. November 7, 2017.

McCourt A. Case Law Arising from Emergency Preparedness, Response, and Recovery Activities. ABA Health Law Section Webinar. November 13, 2018.

Research Objectives

To use public health law research and empirical methods to study the relationship between policy and violence and suicide; to study and assess the effect of laws designed to improve the public's health; to study and assess the incidental public health effects of state and federal policy.

Keywords

law, public health law, gun policy, violence, suicide

Community Service

Students United for Peace (2016–2017)

UA Advance Directives Clinic (2013)

UA Law Student Legal Referral Clinic (2012)