



# Policies to Prevent Illegal Acquisition of Firearms: Impacts on Diversions of Guns for Criminal Use, Violence, and Suicide

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## Abstract

### Purpose of Review

Firearm-related deaths are a significant source of mortality in the USA. More than 30,000 individuals die annually from firearm-related injuries, including homicide and suicide, in our nation. This review summarizes recent findings on policies designed to prevent illegal acquisition of firearms and their impacts on diversions of guns into underground markets and firearm-related homicide and suicide.

### Recent Findings

A significant body of evidence has been produced between 2013 and 2018 demonstrating the effectiveness of laws requiring prospective handgun purchasers to obtain a permit (PTP). The evidence for other types of laws to deter illegal acquisition of firearms is less robust.

### Summary

Current research on illegal acquisition and the impact of related policies illustrates that there are policies that effectively reduce diversion and have positive impacts on firearm-related violence. However, there is a paucity of research that use strong study designs and clearly identifies specific policy impacts pertaining to diversion and illegal acquisition of firearms. Future research is needed that further elucidates transactions that facilitate a gun's entry into an underground market and the role and impact of policies regulating these transactions.

**Keywords** Firearm policy · Underground gun market · Firearm homicide · Firearm suicide

## Introduction

Firearms represent a significant burden of mortality in the USA. In 2016, there were 14,415 firearm homicides and 22,928 firearm suicides [1]. Firearm-related deaths accounted for nearly 8% of years of potential life lost in the USA before age 65 [2].

Because firearms are extremely lethal weapons, governments—both state and federal—have a vested interest in limiting access to firearms for certain subgroups within the overall population, e.g., individuals with a history of violence or serious criminal behavior, underage youth, or those undergoing a mental health crisis [3–7]. Laws and other policies are one means of limiting access. The purpose of this review is to

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summarize recent findings on the effectiveness of policies designed to prevent acquisition and diversion of firearms for illegal activities.

Numerous laws have been enacted with the goal of preventing or deterring the illegal acquisition of firearms by prohibited individuals with the ultimate goal of reducing crime and violence. The Brady Act established the National Instant Check System (NICS), which is used by law enforcement to conduct mandatory background checks of individuals attempting to purchase firearms from retail outlets. This federal law requires mandatory background checks of individuals seeking to purchase a firearm from federally licensed firearm retailers to determine whether a prospective purchaser meets requirements to legally purchase the firearm they seek to purchase. No such requirement exists for firearm sales by private parties. Several states have attempted to address the gap in federal law by developing their own laws to prevent private sales of firearms to prohibited individuals. Nineteen states<sup>1</sup> and Washington, D.C. have comprehensive background check (CBC) laws requiring that prospective firearm purchasers pass a background check before a private seller can legally transfer a firearm. Nine of these 19 states have permit to purchase (PTP) laws that require that every prospective handgun purchaser—regardless of whether the seller is a licensed firearm dealer—obtain a permit or license directly from a law enforcement agency. Issuance of such a permit is contingent upon the prospective purchaser passing background checks and, in some states, mandatory firearm safety training. Additionally, at least 25 states have passed other laws that are specifically designed to prevent firearm trafficking including regulating licensed firearm dealers beyond the requirements of the federal government.

## Methods

In this review, a comprehensive search was completed for literature published between 2013 and 2018 pertaining to underground gun markets and policies to curtail illegal gun acquisition in the USA. Searches were conducted in September 2018. Literature was gathered from PubMed, Criminal Justice Abstracts with Full Text, and NBER using the following search terms: “firearm trafficking,” “illegal gun market,” “straw purchase,” “firearm diversion,” “criminal firearm acquisition,” “universal background checks,” “comprehensive background checks,” “permit to purchase,” “licensing handgun purchasers,” “firearm theft,” “stolen firearms,” “firearm dealer regulation,” “firearm dealer compliance,” and “firearm dealer oversight.” Each term was searched by itself, without other qualifiers. It is also important to note that phrases which

include the word “firearm” were re-searched with the word “gun” as a replacement for “firearm.” We also examined the bibliography of the RAND Corporation Study on Gun Violence and included articles known by the authors to be relevant to this topic. The result was 102 articles total from the databases searched, which were imported into DistillerSR for screening. Of the 102 articles, 55 were excluded after a screening of titles, and of the remaining 47 articles, 13 were excluded upon abstract examination. Out of the 34 articles included in the review, 11 articles discussed underground gun markets and illegal gun acquisition, 6 articles discussed policies to address illegal gun acquisition, and 17 articles examined the effects of such policies on health outcomes.

## Underground Market and Illegal gun Acquisition

Researchers have long sought to understand how criminals obtain guns and how guns are diverted from the legal to the illegal market. Between 2013 and 2018, 11 articles examined the underground market for firearms and patterns of illegal gun acquisition (Table 1). Five of the 11 articles describe where offenders get their guns and why. Two articles focused specifically on the role of gun theft in providing guns for criminal use. Two articles examined illegal firearm sales, and the remaining two examined the limited role of cryptomarkets in the sale of firearms.

The researchers used several approaches to determine where and how offenders obtain firearms. Some used crime gun trace data and law enforcement data to describe the characteristics of firearms used in crimes. A study of crime gun trace data from Chicago found that guns confiscated from gang members were generally old and, therefore, likely to have gone through many transactions [8]. It was rare for a crime gun to have been recently purchased from a licensed dealer. Intermediaries—acquaintances, friends, family—played a much larger role than licensed dealers as proximal sources. Investigations of the origins of relatively old crime guns and the prosecution of those who make illegal transfers years prior to the gun’s recovery in criminal use are very challenging. Thus, the study’s authors suggest that law enforcement should focus on straw purchasers and trafficking relatively soon after retail sale [8]. (A “straw purchase” is the illegal purchase of firearm on behalf of another person who cannot legally purchase one or otherwise does not want their name associated with the transaction). A study of guns purchased from retailers in 1990s and subsequently recovered by Baltimore police found they were more likely than guns that were not linked to crime to be semiautomatic, larger caliber, easily concealed, inexpensive, purchased by individuals that had previously purchased guns recovered by law enforcement, and sold by dealers who had previously sold crime guns [9]. These two studies are somewhat limited by their use of crime gun trace data. The information

<sup>1</sup> Nevada currently has a law requiring a background check for private sales, but it has yet to be implemented

**Table 1** Summary of recent studies on underground gun markets/illegal gun acquisition

Reference	Study design	Location	Time period of data	Main findings
Cook et al. [8]	Longitudinal	Chicago, IL	2009–2013	Examination of traced crime gun data found that 11.4% of guns recovered in a crime had been purchased new from a dealer. Guns retrieved from gang members are rarely purchased new from a dealer (2.8%). Many guns retrieved from gangs are imported from out of state (65.6%).
Koper [9]	Longitudinal	Baltimore, MD	Guns sold 1994–1999 and recovered by police until 2000	Guns recovered by law enforcement in the Baltimore area were more likely to be semiautomatic [HR = 1.341, 95% CI 1.177, 1.528], medium or large caliber [HR = 1.516, 95% CI 1.300, 1.875; HR = 1.408, 95% CI 1.139, 1.740], easily concealed [HR = 1.223, 95% CI 1.090, 1.373], and inexpensive [HR = 1.577, 95% CI 1.259, 1.975]. Guns were also more likely to be recovered if the buyer had previously bought police-recovered guns [HR = 1.627, 95% CI 1.330, 1.992], if the dealer had previously sold crime guns [HR = 1.001, 95% CI 1.001, 1.002], and if a multiple sale took place AND the gun was recovered from someone other than the buyer [HR = 1.227, 95% CI 1.008, 1.495].
Cook et al. [10]	Cross-sectional	Chicago, IL	2013	A majority of respondents reported receiving guns from personal connections rather than from dealers or theft (48.9%); 61.5% of guns were obtained via purchase or trade, and 17.8% were shared with or held by other individuals. Few respondents (1 in 7) reported selling firearms, but fewer used firearm trafficking as a source of income.
Chesnut et al. [11]	Cross-sectional	Los Angeles, CA	2014	Most (50.9%) of the sample acquired illegal guns through a social connection. Firearms were obtained via illegal purchase (66.2%) or received as a gift (19.5%).
Cook [12]	Longitudinal	Chicago, IL	2005–2010, 2010–2014	2.8% of crime guns were found to have been reported stolen. Only 4% of prison and jail inmates and 1% of Federal prisoners responded that they obtained their crime guns via theft.
Webster [13]	Cross-sectional	USA	2004	1 in 10 gun offenders surveyed reported having stolen the gun used in the crime for which they were arrested.
Hemenway et al. [14]	Longitudinal	USA	2015	Owning 6 or more guns [OR = 2.7, 95% CI 1.1, 6.4], owning guns for protective purposes [OR = 3.6, 95% CI 1.3, 10.0] and past-month gun carry [OR = 3.3, 95% CI 1.4, 7.8] were found to be risk factors for gun theft. Best gun storage practices decreased odds of gun theft [OR = 0.2, 95% CI 0.1, 0.8].
Wintemute [15]	Cross-sectional	USA	2011	In the prior year, 67.3% ( $p < 0.0001$ ) of respondents had at least one straw purchase attempt, and 42.4% ( $p < 0.0001$ ) had someone attempt to make an undocumented purchase.
Miller et al. [16]	Cross-sectional	USA	2015	50% [95% CI 35, 65] of gun owners who had purchased a firearm in the past 2 years from a private sale did not complete a background check. For states that regulate private firearm sales, 26% [95% CI 5, 47] of purchasers had not completed a background check.
Broséus et al. [17]	Longitudinal	Internet	2014–2015	1% of listings and 4% of vendors examined were related to firearm transactions, whereas 63% of listings and 69% of vendors were related to illicit drugs and paraphernalia.
Rhumorbarbe et al. [18]	Cross-sectional	Internet	2016	25.4% of weapons listings on the cryptomarkets examined were for firearms.

obtained on transfers is usually limited to the retail transaction by the licensed retail seller to the initial retail purchaser as well as information about the crime linked to the firearm and its criminal possessor.

Some researchers have explored the general character of the crime gun market by asking inmates about how they obtained their guns and why they felt they needed a firearm. A survey of inmates in Chicago found that most guns were acquired from an offender's social network rather than from a store or through theft [10]. While most respondents indicated that they purchased or acquired their gun in a trade, some offenders were caught with a

gun they were sharing with others or that they were holding for someone else. Importantly, survey respondents reported favoring their social networks because purchasing from strangers elevated the risk of arrest [10]. A similar study from Boston found that guns possessed by gang members, in comparison to other crime guns, were more likely to be older and to originate from an out-of-state retail sale [12]. A survey of gun offenders in Los Angeles found that offenders' social connections were far more important than were firearm brokers (those who charged a fee for connecting individuals with illegal suppliers of firearms) [11]. Though these studies provide important insight into the

underground gun market, they may be limited in their generalizability to other cities, states, or regions.

Theft is often hypothesized as being an important method by which criminals acquire guns. A study of guns recovered by police in Chicago found that less than 3% of crime guns had previously been reported stolen [12]. Surveys of Chicago gun offenders also indicated that offenders very rarely steal the guns they used to commit crimes [12]. Data from a nationally representative sample of inmates in state prisons in 2004 found that 10% of those who committed crimes with guns reported that they had stolen the gun they used [13]. While it is still possible that stolen guns end up on the criminal market, it appears that theft of a gun does not usually immediately precede a criminal act with a gun by the thief. A nationally representative survey asked gun owners about gun theft and found that gun owners were more likely to have their guns stolen if they owned six or more guns, carried guns in public, store their guns in an unsafe manner, and stated that they owned guns for protection [14].

If theft plays a relatively small role in direct criminal firearm use, illegal transfers (including those post-theft) likely play a large role. One study from 2013 surveyed licensed dealers and pawnbrokers about straw purchases, undocumented purchases, and theft. Dealers reported that attempts to acquire firearms illegally were quite common—67.3% of respondents had experienced an attempted straw purchase at their establishment and 42.4% had experienced individuals attempting to complete an undocumented purchase [15]. A similar study from 2017 sought to examine the other side of firearm transactions, surveying gun owners to determine where they obtained their most recent firearm. Half of gun owners stated that they had acquired their most recent firearm in a private transfer without a background check. The proportion was nearly halved in states that regulated these private sales [16]. It remains unclear, however, how much these surveys reveal about the way guns used in crimes are acquired. Surveys of inmates and gang members reveal that the most trusted sources of firearms are members of their social networks.

Another oft-hypothesized source of firearms is the Internet. Cryptomarkets—online marketplaces on the “darknet” that enable users to trade illegal goods—are one potential source for firearms. A 2017 study seeking to describe the structure of illegal trafficking on cryptomarkets noted that firearms were available on some of these sites, but traders tended to focus on drugs [17]. A more recent study focused specifically on firearms, extracting webpages from nine cryptomarkets to describe how weapons were trafficked on these sites. The researchers found that weapons were a very small proportion of the illegal trafficking occurring on these sites. Even within the broader weapons category, firearms only accounted for 25% of sales. In truth, the authors argue, cryptomarket firearm transactions are

somewhat limited and tend to be exaggerated [18]. This further supports the idea that unregulated private transactions within social networks may be a larger contributor to the underground gun market.

### **Policies to Deter Illegal Acquisition and Impacts on Diversion**

To limit illegal gun acquisition and hamper the underground gun market, state legislatures have implemented policies designed to deter illegal transfers and acquisitions of firearms. As noted above, these policies include private transfer background check laws (CBC), laws requiring prospective handgun purchasers to obtain a license (PTP), those focusing on firearm trafficking, and state regulation of firearm dealers. Most states, however, have not enacted these laws [19, 20].

Between 2013 and 2018, six articles examined aspects of the relationship between policies to deter illegal acquisition and their intended target, diversion of guns to criminal markets (Table 2). Two of these studies [19, 20] focus on describing current and historic state laws. Three articles focus explicitly on the intended outcome of these laws—the diversion of guns from the legal market to the underground, illegal market [21–23]. One study examined data on prosecutions for violating CBC laws in Maryland and Pennsylvania and revealed that individuals were rarely charged with violating CBC laws. There was a dramatic increase in prosecutions for violating Pennsylvania’s law against straw purchases of guns after state lawmakers increased penalties for straw purchases and a sharp decline in CBC prosecutions in Maryland following a court ruling that significantly elevated standards of proof for CBC violations [24]. The findings suggest that available penalties and standards for evidence required likely affect decisions to investigate and prosecute offenders of laws designed to prevent illegal gun transfers. More research is needed on the frequency with which individuals are prosecuted for violating CBC or related laws, factors that influence decisions to investigate and prosecute such violations, and the impact of enhanced enforcement of the laws. In addition, more research is needed on the implementation and enforcement of PTP laws.

The two studies that examined state laws intended to deter illegal firearm acquisition focused on policies to keep guns away from individuals at the highest risk of committing a criminal act, harming others, or harming themselves [19, 20]. One team of researchers published a large database of firearm laws in place between 1991 and 2016. This database is useful for researchers seeking to evaluate the effect of state law changes. In presenting their database, however, the researchers do not present an appropriately nuanced analysis of these laws, opting instead to compare the number of firearm laws in each state [20]. Few policy implications can be drawn from this analysis; however, the database can be used to more fully characterize the legal environment under which firearms are sold and coupled

**Table 2** Summary of recent studies on policies to address illegal acquisition of firearms

Reference	Study design	Location	Time period of data	Main findings
Vernick et al. [19]	N/A	USA	N/A	This paper discussed background check laws, permit to purchase laws and gun-violence restraining orders as legislative means to reduce gun violence.
Siegel et al. [20]	Longitudinal	USA	1991–2016	The number of laws related to firearms almost doubled between 1991 and 2016, but there was wide variety in numbers of laws enacted across states.
Pierce et al. [21]	Longitudinal	USA	Guns recovered between 2003 and 2006	California's set of gun laws was associated with a 22.1% decrease in relative recovery risk of traced guns as compared to states without firearm purchase or registration laws [HR = 0.78, 95% CI 0.77, 0.79].
Braga and Hureau [22]	Longitudinal	Boston, MA	2007–2013	The median time to law enforcement recovery from last secondary gun transfer was 4.6 years; 37.1% of firearms recovered within 3 years.
Collins et al. [23]	Cross-sectional	USA	2006–2016	Waiting periods for handgun purchases [coeff = -1.94, 95% CI -3.22, -0.67], permit requirements [coeff = -3.88, 95% CI -6.01, -1.75], violent misdemeanor prohibition [coeff = -4.68, 95% CI -7.82, -1.55], and relinquishment upon disqualification [coeff = -3.17, 95% CI -4.95, -1.39] were associated with decreases in guns traced to an in-state source.
Crifasi et al. [24•]	Longitudinal	PA and MD	2006–2015 in PA; 1996–2014 in MD	Prosecutions of straw purchases significantly increased in PA following the passage of a law with heightened sanctions for straw purchases [difference in means = 1310.86, $p = 0.003$ ]. Prosecution significantly decreased in MD following passage of a law that made enforcement more difficult [difference in means = -20.52, $p = 0.026$ ].

with rigorous statistical methods to generate important research findings.

Recent evaluations of state firearm laws have found that strict laws governing private transfers can limit the ability of criminals to acquire guns. An analysis of firearms traced by the Bureau of Alcohol, Tobacco, Firearms and Explosives (ATF) revealed that in states with the strictest laws on firearm transfers and dealer regulations, the firearms used in crime were less likely to have moved swiftly from retail sale to criminal use than was the case in states with weaker gun sales laws. One study found that the broad set of regulations in place in California were associated with the longest interval between gun sales and crime involvement and that PTP laws, especially when coupled with firearm registration requirements, were linked with gun used in crime being older [21]. A study of Massachusetts crime guns found that crime guns moved quickly from private transfer to law enforcement recovery, but most trace data was unavailable to Massachusetts investigators because it was not recorded or reported correctly [22]. A 50-state analysis of recent gun trace data found that four laws were independently associated with decreases in the percentage of guns traced to an in-state source: handgun waiting periods, PTP, violent misdemeanor prohibitions, and a requirement that firearms be relinquished by those who became prohibited from possessing them [23].

One paper found that enforcement and implementation of firearm laws deserve more attention. The study examined gun law prosecutions in two states with CBC laws and found that enforcement of firearm laws is affected by the penalties associated with violating the law and judicial interpretation of the underlying statutes [24•]. This suggests that states with CBC laws must invest more heavily in enforcement and implementation of those laws and that stronger laws may prompt stronger enforcement. More research is necessary to determine whether prosecutions for these crimes and stiff penalties for violators are associated with changes in the criminal firearm market.

In addition to the research described here, additional work is needed to fully elucidate the relationship between policies intended to deter illegal acquisition and the diversion of guns to criminal markets. Perhaps the most important issue underlying this relationship is restrictions on access to crime gun trace data nationally over a span of many years. In 2003, the federal Tiahrt Amendment restricted access to granular crime gun trace data nationally by researchers or others and prohibited use of these data in regulatory decisions (e.g., license renewal) or litigation. Because data are keys to most systems of accountability, the Tiahrt Amendment may have weakened accountability of gun sellers. Prior research has shown that these changes

were associated with increased diversion of guns to the criminal market [25]. Firearm trace data is an important resource for researchers seeking to determine the origin of guns used in criminal acts. Without these data, it is very difficult to evaluate the specific effects of policies intended to inhibit the illegal transfer and acquisition of firearms.

### Impact on Health Outcomes of Policies to Deter Illegal Acquisition

Policies that are designed to prevent illegal acquisition of firearms may also have downstream impacts on health outcomes such as homicide and suicide. Between 2013 and 2018, 17 articles examined the relationship between policies to deter illegal acquisition and firearm-related death (Table 3). All but one of the studies [26•] explored the effects of these policies at the state level. Ten of the 16 studies were longitudinal (or time series) [26•, 27–34, 35•], five used a cross-sectional design [36–40], and two were systematic review articles [41, 42]. Eight articles focused on the outcome of firearm homicide [26•, 27–29, 34, 35, 40, 42], five on firearm suicide [30, 32, 36–38], and one examined both [33]. One paper focused on the outcome of firearm injury [41]. Additionally, one paper examined police officers killed in the line-of-duty [31] and one looked at police killings of civilians [39]. The studies evaluated a range of policies to deter illegal acquisition including PTP, CBC, trafficking, and state regulation of firearm dealers. A challenge is that researchers often combined PTP and CBC laws together in their evaluation, although they are distinct policies, which makes the interpretation of the evidence on CBC laws less clear.

Five studies specifically examined PTP laws; four were longitudinal and one was cross-sectional. Two longitudinal studies examined the effects of Missouri repealing its PTP law but used analytic approaches. Each found evidence that Missouri's PTP law had been protective against firearm homicide [27, 35•]. Another longitudinal study estimated the effects of Connecticut's PTP law and found a relatively large association between the law and reduced rates of firearm homicide [29]. Crifasi et al. studied state-level variation in on-duty fatalities and assaults of law enforcement officers and found PTP law effects suggestive of protections against handgun assaults against police officers [31]. Additionally, one longitudinal paper found PTP to be protective against firearm suicide [30]. The one cross-sectional paper looking specifically at PTP found the laws to be associated with lower firearm suicide [36].

One longitudinal study examined both PTP and CBC and found that while PTP was associated with reductions in firearm homicide, laws requiring CBC without PTP did not show a clear beneficial impact [26•]. Specifically, CBC laws were associated with higher rates of firearm homicides in the main models, but analyses that included

1-, 2-, and 3-year lead and lag variables for CBC laws indicated that firearm homicide rates were increasing with each year approaching the introduction of a new CBC law and then stabilized in the years after CBC laws were in effect. Two other longitudinal studies examining CBC found no protective effects of CBC law against firearm homicide [33, 34]. One also explored firearm suicide and did not find beneficial effects of California's CBC law [33]. This contrasts with one longitudinal and two cross-sectional studies that found protective effects. The longitudinal paper found slower increases in firearm suicide among states with CBC laws [32], and the two cross-sectional studies found lower firearm suicide among states with CBC laws [37, 38]. However, not all the studies finding protective effects appropriately differentiated between states with PTP versus those with only CBC. These results are difficult to interpret and may be due to the impact of PTP laws rather than CBC alone. An additional cross-sectional study explored numerous laws' impacts on firearm mortality and found protective effects of CBC laws [40]; however, the quality of the study design and estimates suggesting that a law that has not yet been implemented had huge protective effects on firearm mortality call into question the validity of the findings.

One study found that laws requiring firearm dealers to obtain state licenses that allowed for law enforcement inspections of firearm sales records were associated with lower firearm homicide rates after controlling for levels of gun ownership and other factors [28]. A limitation of this study was that the laws in question did not change during the study period, thus preventing researchers from linking changes in homicides to changes in laws. Finally, a cross-sectional study found that scores for the restrictiveness of firearm laws, specifically the robustness of backgrounds including whether a PTP is required and anti-gun-trafficking laws, were negatively associated with police fatally shooting civilians [39].

Two systematic reviews were published during our review period that explored the impact of policies to deter illegal acquisition and firearm-related deaths. One found that PTP laws were associated with decreases in firearm mortality [41]. The other review found evidence that stronger CBC laws and PTP laws were associated with lower rates of firearm homicide; however, the authors do not note that the studies linking stronger background checks laws with lower firearm homicide rates were cross-sectional and that PTP laws were weighted contributors to the background check scales [42]. In contrast, protective effects of PTP laws were based on estimates of change over time relative to changes in non-PTP comparison states. This review also notes that neither of the two studies examining the effects of prohibitions on buying more than one firearm per month per person found protective effects against homicides [42].

**Table 3** Summary of recent studies on impact of policies on health outcomes

Reference	Study design	Location	Time period of data	Main findings
Crifasi et al. [26•]	Longitudinal	USA	1984–2015	PTP laws were associated with a 11% decrease in firearm homicides [IRR = 0.89, 95% CI 0.85, 0.93]. Increase in firearm homicide was associated with CBC-only [IRR = 1.10, 95% CI 1.08, 1.13], as well as SYG [IRR = 1.08, 95% CI 1.05, 1.10], RTC [IRR = 1.07, 95% CI 1.05, 1.09] and VM [IRR = 1.24, 95% CI 1.21, 1.27] laws.
Webster et al. [27]	Longitudinal	MO	1999–2010	Using death certificate data, repeal of MO's PTP law was associated with a 23% increase in firearm homicide rates [ $\beta = 1.09, p < 0.001$ ]. Using the FBI's UCR data, repeal of the PTP law was associated with a 16% increase [ $\beta = 0.93, p < 0.001$ ].
Irvin et al. [28]	Longitudinal	USA	1995–2010	Possessing both licensing and inspection laws was associated with reduction in homicide rates [IRR = 0.48, 95% CI 0.42, 0.58]. Having at least 3 laws regulating firearm dealers [IRR = 0.76, 95% CI 0.67, 0.86] or 4 laws [IRR = 0.75, 95% CI 0.65, 0.86] was associated with reductions in firearm homicides as well.
Rudolph et al. [29]	Longitudinal	CT	1984–2005	CT's PTP law was associated with a 40% reduction in firearm homicides over the 10 years after the law was implemented, whereas the comparison area showed no such reduction in firearm-related homicides.
Crifasi et al. [30]	Longitudinal	CT and MO	1981–2012	An estimated 15.4% reduction in firearm suicide rates was associated with CT's PTP law, compared to synthetic controls. An estimated 16.1% increase in firearm suicide rates was associated with the repeal of MO's PTP law, compared to synthetic controls.
Crifasi et al. [31]	Longitudinal	USA	1984–2013 for fatal assaults; 1998–2013 for non-fatal assaults	No significant association was found between RTC laws and fatal [IRR = 0.92, $p = 0.569$ ] or non-fatal [IRR = 0.74, $p = 0.311$ ] handgun assaults on LEOs. CT's PTP law was not significantly associated with fatal handgun assaults on LEOs [IRR = 0.20, $p = 0.159$ ]. Repeal of MO's PTP law was slightly associated with an increase in non-fatal handgun assaults on LEOs [IRR = 2.14, $p = 0.089$ ]. Three-strike laws were associated with an increase in fatal assault risk [IRR = 1.33, $p = 0.16$ ].
Anestis et al. [32]	Longitudinal	USA	1992–2015	Increases in firearm suicide rates were associated with increases in overall state suicide rates [ $b = 1.38, p < 0.001$ ] and decreases in firearm suicide rates were not associated with changes in non-firearm suicide rates ( $b = -0.06, p = 0.59$ ). Higher increases in firearm suicide rates were associated with lack of universal background checks ( $p < 0.01$ ) and lack of mandatory waiting periods ( $p < 0.05$ ).
Kagawa et al. [33]	Longitudinal	USA	1981–2008 in IN; 1994–2008 in TN	Changes in firearm homicide rates pre-repeal vs. post-repeal of CBC laws in Tennessee ( $6.9 \pm 0.6$ vs. $5.4 \pm 0.4$ , respectively) and Indiana ( $4.1 \pm 0.7$ vs. $3.9 \pm 0.3$ , respectively) were not significant. Changes in firearm suicide rates pre-repeal vs. post-repeal of CBC laws in Tennessee ( $9.2 \pm 0.2$ vs. $8.8 \pm 0.4$ , respectively) and Indiana ( $7.5 \pm 0.5$ vs. $6.6 \pm 0.4$ , respectively) were not significant.
Gius [34]	Longitudinal	USA	1980–2011	Background checks from private sellers were found to be associated with increased firearm-related homicide rates, though the increase was non-significant [coeff = 0.059, $p > 0.1$ ]. Both statistics were found to be non-significant.
Hasegawa et al. [35•]	Longitudinal	Missouri	1999–2010; re-examined through 2016	Repeal of Missouri's PTP handgun licensing requirement was significantly associated with an increase in homicide rate [difference-in-difference estimate = 1.2, 95% CI 0.9, 1.5].
Anestis et al. [36]	Cross-sectional	USA	2010	PTP laws were significantly associated with a reduction in rates of suicide by firearms (4.0 per 100,000 vs. 8.8 per 100,000, $p < 0.001$ ).
Anestis and Anestis [37]	Cross-sectional	USA	2013	States with CBC laws had lower rates of firearm suicides than states without CBC laws ( $5.90$ vs. $9.05, p < 0.001$ ).
Anestis et al. [38]	Cross-sectional	USA	2013–2014	From 2013 to 2014, states with universal background checks had a reduction of 0.29 suicides per 100,000 population, whereas states without these laws had an increase in suicides of 0.85 per 100,000 ( $\eta^2 = 0.10$ ).
Kivisto et al. [39]	Cross-sectional	USA	Jan. 1, 2015–Oct. 31, 2016	Firearm legislation at the state level was significantly associated with reduction in fatal police shootings [IRR = 0.961, 95% CI 0.939, 0.984]. States in the top quartile of legislation strength had an IRR that was 51% lower than states in the lowest quartile [IRR = 0.488, 95% CI 0.287, 0.828].
Kalesan et al. [40]	Cross-sectional	USA	Nov. 1, 2014–May 15, 2015	Reductions in firearm mortality were shown to be associated with implementation of CBC laws [IRR 0.39, 95% CI 0.23, 0.67], ammunition background checks [IRR 0.18, 95% CI 0.09, 0.36], and ID requirements for firearms [IRR 0.16, 95% CI 0.09, 0.29].
Crandall et al. [41]	Systematic review	USA	References searched in Nov. 2013, Jun. 2015, and Apr. 2016	Multiple studies have shown significant associations between firearm purchasing restrictions and decreases in firearm injuries.
Lee et al. [42]	Systematic review		Articles published between 1970 and 2016	12 studies examining PTP laws showed associations between PTP and decreases in firearm homicide rates; 17 studies examining firearm trafficking showed inconclusive evidence regarding the effect of PTP laws on firearm trafficking rates.

## Social Acceptability of Laws to Deter Illegal Acquisition of Firearms

Laws intended to deter the illegal acquisition of firearms are popular among both the public and firearm retailers. Respondents to a nationally representative survey overwhelmingly supported laws requiring background checks for private sales (87.8%) and laws requiring accountability for firearm retailers unable to account for missing or stolen firearms (84.8%). Support for these laws was similar among gun owners and those not owning guns [43]. A separate survey found that the majority (72%) of the public agrees that it is unacceptable for someone to sell a gun to a stranger without a background check [44]. Notably, however, this survey did not ask how respondents felt about transfers between acquaintances or family members and did not distinguish between differences in background check systems for CBC versus PTP laws. A survey of federally licensed firearm dealers showed moderate support for private sale background check laws, particularly if they are exposed to illegal activities like individuals attempting to purchase firearms illegally. The surveyed dealers were more supportive of laws outlining specific criteria for denial of handgun purchase, including criminal history, excessive alcohol use, and mental health issues. Again, this survey did not differentiate for dealers between background check systems with CBC versus PTP [45]. While this survey was not representative of all dealers, it contributes to the overall conclusion that laws designed to deter illegal firearm acquisition generally enjoy widespread support.

## Conclusions

Recent research on the effectiveness of permit to purchase (PTP) laws designed to prevent the illegal acquisition of firearms provides strong evidence that these laws reduce the diversions of guns into the underground market, firearm homicides, and firearm suicides. There is also some evidence to suggest that these laws protect against police-involved shootings and assaults against law enforcement officers. While cross-sectional studies find that comprehensive background check (CBC) laws and stronger overall background check systems are associated with lower rates of firearm mortality, longitudinal studies examining the effects of changes in CBC laws have yet to demonstrate that these laws reduce firearm mortality rates. Completeness of records on prohibiting conditions that are used for pre-sale background checks [46] and limited enforcement [25] may weaken compliance with the laws and their impacts on public safety outcomes.

Weaknesses in US Federal laws governing licensed gun sellers and resource constraints for regulatory oversight create conditions that allow large volumes of firearms to be diverted

for criminal use [47, 48]. Some states augment federal regulations and oversight with their own licensing and oversight practices. Although there have not been recent changes in these laws to estimate the effects in longitudinal analyses, after controlling for other factors, states that require firearm dealer licensing and compliance inspections have lower firearm homicides than states lacking those laws.

This review illustrates the effectiveness of policies designed to deter illegal acquisition of firearms. However, it also highlights the relative paucity of research being conducted that uses strong study designs and clearly identifies policy impacts to determine their effectiveness. Only 34 relevant articles were published between 2013 and 2018. Many of these studies examine cross-sectional associations and do not attempt to isolate the impact of changes in specific firearm laws. None of the studies identified used data that distinguished legal versus unlawful purchasers and possessors of firearms based on the laws in place. This is likely a product of challenges in accessing relevant data and limited funding available to evaluate gun policy. Another challenge to this body of research is that there have not been many changes in certain kinds of laws designed to keep guns from legally prohibited individuals (e.g., state licensing and oversight of retail firearm sellers, PTP laws). Given the substantial public health magnitude of firearm-related injury, there is a pressing need to improve the quantity and quality of the research on this topic.

## Compliance with Ethical Standards

**Conflict of Interest** The authors declare that they have no conflicts of interest.

**Human and Animal Rights and Informed Consent** This article does not contain any studies with human or animal subjects performed by any of the authors.

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