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## Alcohol misuse, firearm violence perpetration, and public policy in the United States

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## ABSTRACT

**Objective.** Firearm violence is a significant public health problem in the United States, and alcohol is frequently involved. This article reviews existing research on the relationships between alcohol misuse; ownership, access to, and use of firearms; and the commission of firearm violence, and discusses the policy implications of these findings.

**Method.** Narrative review augmented by new tabulations of publicly-available data.

**Results.** Acute and chronic alcohol misuse is positively associated with firearm ownership, risk behaviors involving firearms, and risk for perpetrating both interpersonal and self-directed firearm violence. In an average month, an estimated 8.9 to 11.7 million firearm owners binge drink. For men, deaths from alcohol-related firearm violence equal those from alcohol-related motor vehicle crashes. Enforceable policies restricting access to firearms for persons who misuse alcohol are uncommon. Policies that restrict access on the basis of other risk factors have been shown to reduce risk for subsequent violence.

**Conclusion.** The evidence suggests that restricting access to firearms for persons with a documented history of alcohol misuse would be an effective violence prevention measure. Restrictions should rely on unambiguous definitions of alcohol misuse to facilitate enforcement and should be rigorously evaluated.

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The Institute of Medicine considers firearm violence “a serious threat to the safety and welfare of the American public” (Institute of Medicine and National Research Council, 2013). The overall mortality rate from firearm violence has remained essentially unchanged in the United States for more than a decade (Wintemute, 2015). Acute alcohol intoxication and chronic alcohol misuse have well-established and important associations with violence—including homicide and suicide, which are most often committed with firearms in the United States.

This narrative review summarizes existing research on the relationships between alcohol misuse, access to and use of firearms, and the perpetration of firearm violence. Findings from the literature are augmented by new tabulations of publicly-available data. The article describes the limited existing policies that restrict firearm access for reasons related to alcohol misuse and assesses the effectiveness of restrictions for members of other high-risk groups. It considers whether, given the evidence, firearm access should be more broadly restricted for persons with a documented history of alcohol misuse. Reviews of the relationship between alcohol and violence

generally and of underlying theories and mechanisms are presented in appendices.

“Alcohol misuse” is used here to refer collectively to excessive use, abuse, and dependence, which have distinct (and variable) definitions. Where more specific terms are used, they appear in the article under discussion. “Violence” denotes intentional injury, whether inflicted on another or oneself.

There are limits to the scope of this review. Victimization from interpersonal violence, not discussed here, is also associated with alcohol misuse (Cherpitel and Ye, 2010; Darke, 2010; Macdonald et al., 2005; Parks et al., 2014), including where firearms are involved (Branas, 2014). Studies of firearm access and risk for violence perpetration were included only if alcohol use was also considered. Given this article's focus on risk-based policy for firearm access in the United States, research on juveniles (who may not own firearms), on social determinants of risk, on other forms of firearm policy, and from other countries was generally excluded.

### Exposure, mortality, and cost

#### Firearms

Exposure to firearms is very common in the United States. Roughly 300 million firearms are in civilian possession in this country—about 45% of all civilian-owned firearms worldwide, though the United States accounts for only about 4.5% of the world's population

**Abbreviations:** BAC, blood alcohol concentration; CDC, Centers for Disease Control and Prevention; DSM, Diagnostic and Statistical Manual of the American Psychiatric Association (Roman numerals indicate editions); DUI, driving under the influence; NRA, National Rifle Association.

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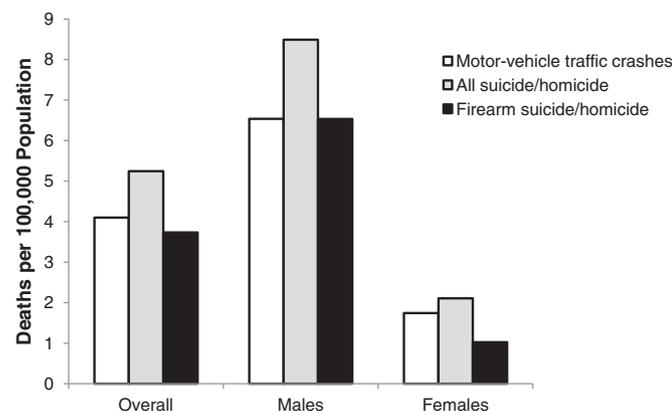
(Graduate Institute of International Studies, 2007). General Social Survey (GSS) data for 2010 suggest that there are approximately 50 million firearm owners in the United States, including about 35% of men and 11% of women (General Social Survey). Firearm exposure is not limited to personal ownership, of course. According to the GSS, 32.3% of households have firearms. This suggests, given some 116.7 million households in the United States in 2010 with, on average, 2.58 members each (Lofquist et al., 2012), that approximately 97 million individuals have household exposure to firearms.

Firearm violence has long ranked among the leading causes of death in the United States (Mokdad et al., 2004). Firearms were used in 69.5% of all homicides and 51.5% of all suicides in 2013, the most recent year for which data are available (National Vital Statistics Reports, 2014). There were 11,208 firearm homicides and 21,175 firearm suicides that year; an estimated 66,191 individuals were treated in hospital emergency departments for intentionally-inflicted gunshot wounds (Centers for Disease Control and Prevention). An estimated 332,951 firearm-related “serious violent victimizations” occurred in 2013, including 18.9% of all robberies and 25.3% of aggravated assaults for which weapon status was reported (Bureau of Justice Statistics).

### Alcohol

Alcohol use and misuse are also very common. In the 2012 Behavioral Risk Factor Surveillance System (BRFSS) survey, 55.3% of respondents reported alcohol consumption in the previous 30 days. Binge drinking ( $\geq 5$  drinks on one occasion for males,  $\geq 4$  for females) was reported by 16.9%, and heavy drinking ( $>2$  drinks/day for males,  $>1$  for females) was reported by 6.1% (Centers for Disease Control and Prevention).

Alcohol also ranks among the leading causes of death in the United States, responsible for some 88,000 deaths annually (Esser et al., 2014). Many of these deaths represent alcohol-related increases in risk of death from other causes, such as injury. CDC’s Alcohol-Related Disease Impact (ARDI) service provides estimates of cause-specific, alcohol-attributable deaths (Centers for Disease Control and Prevention; Gonzales et al., 2014). ARDI estimates, which are averages for 2006–2010, suggest that alcohol-attributable mortality rates for violence exceed those for motor vehicle traffic crashes, among both men and women (Fig. 1). For men, mortality



**Fig. 1.** Rates of alcohol-attributable death from motor-vehicle traffic crashes, suicide and homicide by all means, and firearm suicide and homicide, 2006–2010 average. Footnote to figure: These data underestimate alcohol-attributable homicide relative to alcohol-attributable motor-vehicle crash deaths. Homicide is classified as alcohol-attributable if the perpetrator is intoxicated; deaths in which the perpetrator is not intoxicated, but the victim is, are not included. Motor-vehicle crash deaths are classified as alcohol-attributable if any driver is intoxicated. Data on alcohol-attributable deaths and alcohol-attributable fraction of deaths by cause (for motor vehicle deaths, homicide, and suicide) available at [http://apps.nccd.cdc.gov/DACH\\_ARDI/Default/Default.aspx](http://apps.nccd.cdc.gov/DACH_ARDI/Default/Default.aspx). Data on firearm homicide and suicide available at <http://www.cdc.gov/injury/wisqars/index.html>. To prepare the figure, the alcohol-attributable fractions for homicide and suicide were applied to firearm homicide and suicide.

from alcohol-attributable firearm violence alone equals that for motor vehicle traffic crashes. This is true even though alcohol involvement is underestimated in fatal violence relative to motor vehicle crashes (see notes to Fig. 1).

### Alcohol and firearms in combination

The number of firearm owners who use or misuse alcohol can be estimated with data from the 2010 Census on population, the GSS on firearm ownership, and the BRFSS on drinking. Assuming that firearm owners binge drink and drink heavily no more frequently than does the general population, an estimated 8.9 million firearm owners binge drink and 2.5 million drink heavily in any 30-day period (Table 1). The assumption is probably wrong, however. BRFSS also revealed that, after adjustment for age, sex, race, and state of residence, firearm owners were more likely than others to report binge drinking (Odds Ratio (OR) 1.32, 95% Confidence Interval (CI) 1.16–1.50) and heavy drinking (OR 1.45, 95% CI 1.14–1.83) (Wintemute, 2011). Incorporating those data yields estimates of 11.7 million firearm owners who binge drink and 3.6 million who drink heavily in any 30-day period (Table 1).

### Cost

Firearm violence and alcohol misuse are very costly. The 2012 aggregate societal costs for firearm deaths and injuries of all types were estimated at \$229 billion (Follman et al., 2015). Overall costs to society of excessive drinking were estimated at \$223.5 billion in 2006 (approximately \$1.90 per drink consumed); costs just for alcohol-related crimes were an estimated \$73.3 billion (Bouchery et al., 2011).

### Alcohol misuse, firearms, and violence

In prevalence studies, to the extent that the questions have been asked, persons with alcohol or other substance abuse disorders, other forms of serious mental illness, impulsive anger, and suicidal ideation have reported the presence of firearms in the home (as distinct from personal firearm ownership), gun carrying outside the home, and storing firearms both loaded and not locked away at frequencies that approximate those in the general population (Swanson et al., 2015) (Ilgen et al., 2008; Miller et al., 2009; Oslin et al., 2004; Sorenson and Vitti, 2008).

Of central importance for the present purpose, many studies have found associations between alcohol misuse and firearm ownership, firearm access, and/or specific firearm-related behaviors, and between the combined presence of these factors and increased risk for interpersonal violence and self harm. Personal firearm ownership and firearm access without ownership are not always distinguished, unfortunately, and no studies distinguish legal from illegal ownership. (Many other studies, reviewed in the appendices, have documented an association between alcohol misuse and violence generally—including homicide and suicide, which are most often committed with firearms.)

In an early example from Illinois, 19% of firearm owners but 9% of controls reported that “they became ‘drunk’ several times a month or more.” Firearm owners were more likely than others to have been arrested or convicted; this difference was not statistically significant (Diener and Kerber, 1979).

A large nationwide survey of college undergraduates found that, in a multivariate analysis, those who “possess[ed] a working handgun” were more likely than others to “need an alcoholic drink first thing in the morning” (OR 2.0, 95% CI 1.3–3.1); to have had a DUI arrest, committed property damage, or driven after binge drinking (OR 1.6, 95% CI 1.2–2.1); or to have had an “alcohol-related injury serious enough to see a doctor” in the prior year (OR 2.5, 95% CI 1.6–4.0) (Miller et al., 1999). Approximately 20% of those injuries resulted from interpersonal violence.

In a follow-up survey, firearm ownership was no more common among non-binge drinkers than among non-drinkers (OR 0.9) but was

**Table 1**  
Estimated 30-day prevalence of binge drinking and chronic heavy drinking among firearm owners in the United States.

Gender	Firearm owners <sup>a</sup>	Firearm owners who binge drink in any 30-day period		Firearm owners who drink heavily in any 30-day period	
		Based on general population estimate <sup>b</sup>	Based on increased prevalence among firearm owners <sup>c</sup>	Based on general population estimate <sup>d</sup>	Based on increased prevalence among firearm owners <sup>e</sup>
Male	37,408,145	7,556,445	9,974,508	1,907,815	2,766,332
Female	12,548,628	1,305,057	1,722,676	564,688	818,798
Total	49,956,773	8,861,503	11,697,183	2,472,504	3,585,130

<sup>a</sup> Based on the number of persons ages 21 and older in the 2010 Census and the reported prevalence of personal firearm ownership (35% for males, 11% for females) in the 2010 General Social Survey.

<sup>b</sup> Based on the estimated number of firearm owners by gender and the gender-specific prevalence of binge drinking in the preceding 30 days (20.2% for males, 10.4% for females) for the general population in the 2010 Behavioral Risk Factor Surveillance System survey. Binge drinking is defined as  $\geq 5$  drinks on an occasion for men and  $\geq 4$  drinks on an occasion for women.

<sup>c</sup> Based on the increased prevalence of binge drinking among firearm owners (OR 1.32, adjusted for age, sex, race, and state of residence) (Wintemute, 2011).

<sup>d</sup> Based on the estimated number of firearm owners by gender and the gender-specific prevalence of heavy drinking in the preceding 30 days (5.1% for males, 4.5% for females) for the general population in the 2010 Behavioral Risk Factor Surveillance System survey. (Centers for Disease Control and Prevention) Heavy drinking is defined as 15 or more drinks per week in men or 10 or more drinks per week in women.

<sup>e</sup> Based on the increased prevalence of heavy drinking among firearm owners (OR 1.45, adjusted for age, sex, race, and state of residence) (Wintemute, 2011).

increased among binge drinkers who did not drive after drinking (OR 1.6,  $p < 0.01$ ) and increased still further among students who drove after binge drinking (OR 2.3,  $p < 0.001$ ) (Miller et al., 2002). Firearm owners were more likely than others to report committing alcohol-related vandalism (21% and 10%, respectively) and having “trouble with the police” (10% and 6%, respectively).

Carrying firearms in public has been linked to both alcohol misuse and criminal activity. A 2001 nationwide survey by the National Opinion Research Center found that persons who reported carrying firearms in public were more likely than others to “sometimes drink more than they should” (26.1% and 17.7%, respectively) and to be arrested for a non-traffic offense (29.1% and 20.7%, respectively) (Smith, 2001). In Oregon, persons who carried loaded firearms outside the home reported binge drinking more frequently than others did (8.7% and 3.6%, respectively); this difference was not statistically significant in multivariate analysis (OR 1.5, 95% CI 0.9–2.4) (Nelson et al., 1996). In Kentucky, frequent and heavy alcohol consumption was directly associated with plans to acquire a “concealed gun license” ( $\beta = 0.192$ ) and also appeared to mediate effects associated with age, sex, education, and income (Schwaner et al., 1999).

Several studies have focused specifically on alcohol misuse and violent or aggressive firearm behaviors. In the nationally-representative National Comorbidity Study Replication (NCS-R), persons who reported threatening others with a firearm were more likely than others to meet DSM-IV criteria for alcohol abuse (OR 3.21, 95% CI 2.31–4.45) or dependence (OR 2.91, 95% CI 1.92–4.43) (Casiano et al., 2008). Risk associated with alcohol abuse and dependence combined remained elevated (OR 1.62, 95% CI 0.98–2.68) in multivariate analysis, while risks associated with other mental illnesses were generally not statistically significant.

A recent analysis of NCS-R data explored the relationship between firearm access and use, alcohol or illicit drug abuse (considered together), and “impulsive angry behavior,” defined by an endorsement of one or more of the statements: “I have tantrums or angry outbursts,” “Sometimes I get so angry I break or smash things,” and “I lose my temper and get into physical fights” (Swanson et al., 2015). Persons with alcohol or illicit drug abuse were substantially more likely than others to exhibit a combination of angry behavior and either carrying firearms outside the home (OR 2.4) or having firearms at home (OR 2.7). Results for persons with alcohol or illicit drug dependence were similar: OR 3.5 for angry behavior and firearm carrying, OR 2.7 for angry behavior and having a firearm at home. ( $P$  in all cases was  $< 0.05$ ).

The aggressive behaviors known as road rage are also associated with alcohol misuse and firearm access. In multivariate analysis of nationally-representative survey data, those who “made obscene or rude gestures at another motorist” and “aggressively followed another vehicle too closely” were more likely than others to binge drink (OR 2.3, 95% CI 1.4–3.8) or carry firearms in their vehicles (OR 1.7, 95% CI 1.0–2.9) (Hemenway et al., 2006).

A study of BRFSS data examined associations between personal ownership of firearms, alcohol use, and risk behaviors involving both alcohol and firearms in some detail (Wintemute, 2011). In multivariate analysis, firearm owners were more likely than persons who had no firearms at home to binge drink (OR 1.3, 95% CI 1.2–1.5), to drink heavily (OR 1.5, 95% CI 1.1–1.8), and to drink and drive (odds ratio 1.8, 95% CI 1.3–2.4). Among firearm owners, those engaging in firearm-related risk behaviors were more likely than others to misuse alcohol or engage in alcohol-related risk behaviors. For example, as compared with persons who had no firearms at home, risk for drinking and driving was highest for firearm owners who drove or rode in a vehicle with a loaded firearm (OR 3.0, 95% CI 1.9–4.7) and less elevated among firearm owners who did not travel with loaded firearms (OR 1.6, 95% CI 1.6–2.6).

A case-control study of persons incarcerated for violent crimes yielded intriguing findings regarding the joint influences of alcohol and firearms on the outcome of violent events (Phillips et al., 2007). Case inmates were convicted of homicide; controls, of assault. In multivariate analysis, status as a case was associated both with alcohol intoxication (with a dose response effect) and firearm possession (OR, 8.1). But alcohol intoxication also predicted firearm possession (again with a dose-response effect); some intoxicated subjects left the scene of the conflict, acquired firearms, and returned. The authors suggest that intoxication may increase the likelihood of possessing a firearm in a conflict situation, which in turn increases the likelihood that the conflict will have a fatal outcome.

#### Suicide and homicide

Suicide has been studied extensively; there is no uncertainty about the identity of the perpetrator, and toxicology reports are frequently available. In Arthur Kellermann’s seminal case-control study (Kellermann et al., 1992), firearm suicide in the home was associated with all three of the variables “gun kept in the home” (OR 4.8, 95% CI 2.7–8.5), “drinks alcohol” (OR 2.3, 95% CI 1.2–4.1) and “previous hospitalization due to drinking” (OR 16.4, 95% CI 3.2–85.3) in a multivariate analysis. In the 1993 National Mortality Followback Survey, suicide was associated with both household access to firearms (OR 2.6, 95% CI 2.3–3.0) and excessive alcohol consumption (OR 1.5, 95% CI 1.4–1.7), again in a multivariate analysis (Kung et al., 2005). Risk associated with firearms was much greater for those who lived alone (Kung et al., 2003), a characteristic suggesting personal firearm ownership and social isolation.

A recent case-control study powerfully emphasized the risk for firearm suicide involved with acute intoxication (Branas et al., 2011). Odds ratios for firearm suicide or near-suicide associated with acute alcohol consumption were 5.9 overall (95% CI 2.9–12.1), 2.5 for “non-excessive” consumption (95% CI 1.1–6.0), and a remarkable 85.8 for “excessive” consumption (95% CI 10.0–732.3).

Suicide is particularly likely to involve firearms when alcohol is involved. According to NVDRS data for 2003–2009, acute alcohol intoxication is found in firearm suicide more frequently than in suicide by other methods (OR 1.8, 95% CI 1.6–1.9 for men; OR 1.7, 95% CI 1.5–1.9 for women, compared with suicide by poisoning) (Kaplan et al., 2013). Risk that suicide will be committed with a firearm, rather than by some other method, is directly related to the BAC (Conner et al., 2014; Hlady and Middaugh, 1988). Among survivors of self-inflicted but nonfatal firearm injuries, the prevalence of acute alcohol intoxication ranged from 25% to 35% across several uncontrolled series (de Moore et al., 1994; Frierson and Lippmann, 1990; Peterson et al., 1985).

This relationship appears not to hold for homicide, however. A meta-analysis of studies of alcohol use among homicide offenders reported a weighted mean prevalence of acute alcohol use of 34% among those who used firearms, but 59% among those who used other weapons (Kuhns et al., 2014).

Studies of intimate partner homicide among women emphasize the risk for violence perpetration associated with their partners' firearm access and alcohol misuse. In New Mexico, 89% of intimate partner homicide-suicides (all with female homicide victims) involved firearms; 46% of the perpetrators had elevated BACs (mean 0.13 mg/dl) (Banks et al., 2008). In a separate study, women's risk for homicide was increased when their partners were "problem alcohol drinker[s]" or had access to firearms (Campbell et al., 2003). Alcohol misuse was not retained in multivariate analysis, largely due to the effects of co-existing controlled substance misuse. An earlier multi-state case-control study found in multivariate analysis that women's risk for homicide was increased when a firearm was in the home (OR 3.4, 95% CI 1.6–7.1) (Bailey et al., 1997). "Drinking problems" by any household member were strongly associated with homicide risk when considered alone (OR 14.0, 95% CI 3.0–65.4); this variable was not retained in multivariate analysis because "it appeared to be collinear with domestic violence."

### Federal and State policies on firearms and alcohol

Policies intended to prevent firearm violence often focus on individuals believed to be at high risk for committing such violence. Federal statutes, for example, prohibit the purchase and possession of firearms by persons who have been convicted of any felony or domestic violence misdemeanor, who are subject to a domestic violence restraining order, have been found to be "an unlawful user of or addicted to any controlled substance," have been "adjudicated as a mental defective" or "committed to any mental institution," and others (United States Code). Recent Supreme Court decisions have affirmed that a right to purchase and possess firearms is subject to restriction (*District of Columbia v. Heller*, 2008; *McDonald v City of Chicago*, 2010).

Federal firearm statutes are essentially silent on alcohol. They do not restrict access to firearms by persons who are intoxicated or have a history of alcohol misuse, including prior convictions for alcohol-related offenses. The controlled substance language does not apply to alcohol, as the term "does not include distilled spirits, wine, [or] malt beverages" (Code of Federal Regulations). Alcohol-related restrictions are implicitly left to the states, in that federal firearm licensees may not transfer firearms "to any person in any State where the purchase or possession by such person of such firearm would be in violation of any State law" (United States Code).

Thirty-seven states, with jurisdiction over 65% of the US population, have in some manner restricted the acquisition, possession, or use of firearms by persons who are intoxicated or have a history of alcohol misuse (Carr et al., 2010; Nichols, 2013; Regional Justice Information Service, 2006; Webster and Vernick, 2009). Many such restrictions are arguably unenforceable, due primarily to their reliance on vague, inherently subjective definitions of intoxication or misuse. The states with minimal or no policies regarding firearms and alcohol include several with otherwise extensive statutes regulating possession and use of firearms: California, Hawaii, Illinois, and New York.

Policies restricting firearm access by intoxicated persons are most common, appearing in 26 states, according to Carr and colleagues (Carr et al., 2010). Six states restrict sale or transfer to an intoxicated person; 20 restrict possession and/or use by an intoxicated person; and 5 restrict concealed carrying while intoxicated. Specific criteria for determining intoxication are sometimes given—a threshold BAC or the level used in the state's DUI statute (Carr et al., 2010). In other cases the standard is qualitative and vague. The relevant language in Alaska, for example, is "impaired as a result of the introduction of an intoxicating liquor," with "substantially" sometimes added (Alaska Statutes).

Again according to Carr and colleagues, 18 states restrict firearm access by persons with a history of alcohol misuse. Four states restrict sale or transfer; 3 restrict possession; 7 restrict licensure to purchase or possess; and 8 restrict concealed carrying (Carr et al., 2010). Vague, subjective definitions of prior alcohol misuse are most common: "habitual drunkard" (New Jersey, Alabama, South Carolina); "habitually in an intoxicated condition" (Missouri); "chronic alcoholic" (Ohio); "addicted to alcohol" (Tennessee, West Virginia) (Nichols, 2013).

Only Maryland, Pennsylvania, Indiana, and the District of Columbia have generally restricted firearm acquisition or possession based on specific, quantifiable definitions of alcohol misuse (Carr et al., 2010; Nichols, 2013; Webster and Vernick, 2009). Where available, the data on enforcement are not encouraging.

In Maryland, "a person may not possess a regulated firearm if the person...is a habitual drunkard" (Maryland Code 5-133(b)), where "habitual drunkard" is defined as "a person who has been found guilty of any three [DUI offenses involving alcohol or drugs], one of which occurred in the past year" (Maryland Code 5-101(a)). (Regulated firearms include handguns and assault-type weapons.) Maryland conducts background checks for purchases of regulated firearms that would identify DUI offenses but does not maintain statistics on how many purchases are denied on this basis. (Personal communication, Assistant Attorney General Mark Bowen, April 2, 2014.) Maryland also does not record how many individuals are charged for firearm possession in violation of this prohibition. (Personal communication, Bonita Cosgrove, Director, Research and Statistics, Department of Public Safety and Correctional Services, March 28, 2014.)

In Pennsylvania, "a person...shall not possess, use, control, sell, transfer or manufacture or obtain a license to possess, use, control, sell, transfer or manufacture a firearm" if that person meets any of several specified criteria, including having "been convicted of driving under the influence of alcohol or controlled substance...on three or more separate occasions within a five-year period" (Pennsylvania Consolidated Statutes). During the five years 2009–2013, there were 12 charges filed for violations of the DUI prohibition and 2 convictions. During that same time, there were 41,238 charges filed for violations of other firearm prohibitions and 6828 convictions. (Data provided by the Administrative Office of Pennsylvania Courts, May 23, 2014.)

Indiana statutes provide that "it is unlawful for a person to sell, give, or in any manner transfer the ownership or possession of a handgun to another person who the person has reasonable cause to believe...is an alcohol abuser" (Indiana Code), where "alcohol abuser" is defined as "an individual who has had two (2) or more alcohol related offenses, any one (1) of which resulted in conviction by a court or treatment in an alcohol abuse facility within three (3) years prior to the date of the application" (Indiana Code). Indiana courts have held that DUI offenses are among the alcohol related offenses described in the statute (Nichols, 2013). No information on purchase or possession enforcement was available from Indiana.

In the District of Columbia, "no [handgun] registration certificate shall be issued to any person ... unless the Chief determines that such person ... has not been convicted within 5 years prior to the application of ...two or more violations of any law restricting driving under the influence of alcohol or drugs" (District of Columbia Code). During 2009–2013, no certificates were declined on this basis, though on average, 1696 DUI arrests were made annually during those years. (Data

provided by the Office of the General Counsel, Metropolitan Police Department, District of Columbia; April 30 and September 9, 2014.)

Some states have specific alcohol-related criteria for restricting firearm use, as distinct from possession (Nichols, 2013). In Arkansas, a permit to carry a concealed firearm may not be issued if the applicant “chronically or habitually use[s] an alcoholic beverage to the extent that his or her normal faculties are impaired,” where “it is presumed that an applicant chronically and habitually uses an alcoholic beverage to the extent that his or her normal faculties are impaired if the applicant ... has been convicted of two (2) or more offenses related to the use of alcohol ... within the three-year period immediately preceding the date on which the application is submitted” (Arkansas Code).

Similarly, Kentucky allows the issuance of a concealed-carry permit only if the applicant “does not chronically and habitually use alcoholic beverages as evidenced by the applicant having two (2) or more convictions for violating KRS 189A.010 within the three (3) years immediately preceding the date on which the application is submitted” (Kentucky Revised Statutes). (The statute referred to is Kentucky’s per se DUI law.)

At least 7 states (California, Hawaii, Kansas, Massachusetts, Minnesota, Rhode Island, and Wisconsin) restrict firearm access by individuals who have been committed for or are otherwise subject to involuntary treatment for alcohol misuse or have been placed under conservatorship for disability arising from alcohol misuse (Carr et al., 2010; Nichols, 2013).

Other policies are place-based, rather than person-based. Twelve states restrict firearm possession in places, such as bars and taverns, where alcohol is sold for on-site consumption (Carr et al., 2010). Place-based policies are not always restrictive, however, and have the potential to increase contact between intoxicated individuals and firearms. At least 7 states (Arizona, Georgia, Ohio, North Carolina, South Carolina, Tennessee, and Virginia) permit carrying of firearms in bars under specified conditions, as long as the carrier is not drinking. Others, such as Kentucky and Louisiana, allow firearms in restaurants that serve alcohol but derive most of their income from sales of food.

### Effectiveness of regulation

Efforts to prevent firearm violence by regulating access to firearms are based on the means reduction approach to violence prevention (Johnson and Coyne-Beasley, 2009; Sarchiapone et al., 2011). Many general population studies, only a few of which are cited here, have established an association between the prevalence of access to firearms and risk of firearm violence (Killias, 1993; Miller et al., 2007a,b; Wintemute et al., 1999). The means reduction approach holds that if the prevalence of access is reduced, some violent acts will not occur and the consequences of others will be mitigated.

There is good evidence that increased regulation of firearm access in the general population is effective, particularly with regard to suicide (Florentine and Crane, 2010; Loftin et al., 1991; Mann et al., 2005; Sloan et al., 1988; Yip et al., 2012). One partial exception is the Brady Handgun Violence Prevention Act, which required background checks for purchases by licensed retailers. The Brady Act was linked to a reduction in suicide but appeared to have no effect on homicide (Ludwig and Cook, 2000). This has been attributed primarily to limitations in the Act itself; it exempts firearm sales by unlicensed private parties, which account for some 40% of firearm acquisitions overall in the United States (Cook and Ludwig, 1996) (Wintemute, 2013) and at least 80% of acquisitions made with criminal intent (Harlow, 2001; Scalia, 2000; Vitti et al., 2012).

The most relevant research concerns policies that selectively reduce firearm access among members of high-risk groups. The strongest evidence comes from a quasi-experimental evaluation of California’s decision in 1990 to extend its prohibitions to persons convicted of violent misdemeanors, for 10 years following their convictions (Wintemute et al., 2001). The intervention group comprised persons who sought to purchase handguns in 1991 and were denied under the new policy.

The control group included persons who sought to purchase handguns in 1989 or 1990, before the policy changed, and whose purchases were approved. In multivariate analysis, persons whose purchases were approved were more likely than those who were denied to be arrested for a firearm-related or violent offense (relative hazard (RH) 1.29, 95% CI 1.04–1.60) but not for other offenses (RH 0.96, 95% CI 0.78–1.19). This specificity supported the hypothesis that the observed effect was related to the new policy. A second longitudinal study yielded similar results for the effectiveness of purchase denial based on a prior felony conviction (Wright et al., 1999).

A quasi-experimental study of denial for serious mental illness in Connecticut also found beneficial effects (Swanson et al., 2013). The 23,292 subjects all had serious mental illness, and 85.9% had co-occurring alcohol or drug misuse. Connecticut began reporting prohibitions based on mental health events to the National Instant Criminal Background Check system (NICS) in 2007; the study compared subjects who became prohibited persons before reporting began with those whose prohibitions were reported. In multivariate analysis, the latter group had a substantially decreased risk of arrest for a violent crime during follow-up (OR 0.69, 95% CI 0.57–0.82).

Cross-sectional studies have used population-level data to assess firearm restrictions for high-risk groups and have produced mostly positive findings. State firearm prohibitions for persons subject to domestic violence restraining orders were associated with 7% to 20% declines in the female intimate partner homicide rate (Vigdor and Mercy, 2003, 2006; Zeoli and Webster, 2010). No such effect was observed for persons prohibited because they had been convicted of domestic violence misdemeanors. The two affected populations overlap, however, which may complicate efforts to assign observed effects to one policy rather than the other.

### Acting on the evidence

The available evidence is that acute alcohol intoxication and a history of alcohol misuse are independent risk factors for firearm violence. Policies that restrict firearm access by persons with other risk factors for have been shown to be effective. Properly-crafted policies addressing firearm access for persons who misuse alcohol are likely to be effective as well.

The critical flaw in most existing alcohol-related restrictions on firearm access is the vague and subjective definitions that render enforcement difficult or impossible. Policies seeking to reduce alcohol-related motor vehicle deaths and injuries were rewritten nationwide to eliminate a similar defect. The resulting per se laws—laws that rely on specific prohibition criteria and therefore can often be implemented administratively—have been shown to reduce concurrent use of alcohol and motor vehicles and alcohol-related motor vehicle deaths (McArthur and Kraus, 1999; Wagenaar and Maldonado-Molina, 2007). Specific, objective criteria for firearm access restrictions could include a specified BAC as a marker of acute intoxication and a history of multiple convictions for DUI and other alcohol-related offenses during a specified recent period of time as a marker of alcohol misuse.

Administrative enforcement is feasible for firearm transactions that involve background checks—acquisitions from licensed retailers, including pawn redemptions, and permits to carry concealed firearms. This would require that the databases accessed for background checks include records of alcohol-related convictions. Most states currently rely on NICS background checks, the data for which do not routinely include non-felony alcohol offenses (Regional Justice Information Service, 2006). States that serve as points of contact for background checks and require checks for private-party firearm transfers would have the least difficulty establishing administrative enforcement.

The potential effectiveness of per se firearm laws, and all other efforts to prevent acquisition of firearms by prohibited persons, is reduced in states that do not require background checks for all firearm transfers (Wintemute, 2013). An increasing number of states have adopted such

comprehensive requirements, which the available evidence suggests are independently effective in reducing firearm violence (Webster and Wintemute, 2015).

In 2013, the Consortium for Risk-Based Firearm policy, a nationwide group of academic experts, reviewed the evidence and recommended a 5-year prohibition on the purchase and possession of firearms following a second conviction for an alcohol-related offense in a 5-year period (Consortium for Risk-Based Firearm Policy, 2013a, b; McGinty et al., 2014). Survey research has shown strong support among the general public, firearm owners, NRA members, and licensed firearm retailers for firearm restrictions related to alcohol misuse (Barry et al., 2013; Teret et al., 1998; Wintemute, 2014). Comprehensive background check requirements also receive strong support (Barry et al., 2013; Teret et al., 1998; Wintemute, 2014) and were enacted by 6 states in 2013–2014.

## Conclusion

Firearm access, including personal firearm ownership, and alcohol misuse are both common in the United States. They appear to be associated with one another, and both are associated with an increase in risk for committing firearm violence. Restricting access to firearms by persons who misuse alcohol would likely prevent violence, if restrictions were well-designed and enforced. States enacting such restrictions would be acting in accord with a large body of empirical evidence. To add to that evidence, any such enactments should be rigorously evaluated.

## Conflict of Interest

The author declares that there are no conflicts of interests.

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## Appendix A. Supplementary data

Supplementary data to this article can be found online at <http://dx.doi.org/10.1016/j.jpmed.2015.04.015>.

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