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State background checks for gun purchase and firearm deaths: An exploratory study

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ABSTRACT

Objective. This study examines the relationship between the types of background-information check required by states prior to firearm purchases, and firearm homicide and suicide deaths.

Methods. Negative binomial models are used to analyze state-level data for homicides and suicides in the U.S. from 1996 to 2005. Data on types of background information are retrieved from the Surveys of State Procedures Related to Firearm Sales, and the violent death data are from the WISQARS. Several other state level factors were controlled for.

Results. More background checks are associated with fewer homicide (IRR:0.93, 95% CI:0.91–0.96) and suicide (IRR:0.98, 95% CI:0.96–1.00) deaths. Firearm homicide deaths are lower when states have checks for restraining orders (IRR:0.87, 95% CI:0.79–0.95) and fugitive status (IRR:0.79, 95% CI:0.72–0.88). Firearm suicide deaths are lower when states have background checks for mental illness (IRR:0.96, 95% CI:0.92–0.99), fugitive status (IRR:0.95, 95% CI:0.90–0.99) and misdemeanors (IRR:0.95, 95% CI:0.92–1.00). It does not appear that reductions in firearm deaths are offset by increases in non-firearm violent deaths.

Conclusions. More extensive background checks prior to gun purchase are mostly associated with reductions in firearm homicide and suicide deaths. Several study limitations are acknowledged, and further research is called for to ascertain causality.

Background

Firearm violence remains a major issue in the USA. By some estimates the annual cost of firearm violence is as high as $100 billion (Cook and Ludwig, 2002), firearm violence takes away approximately 104 days from an average American life (Lemaire, 2005), and there is evidence based on 'willingness to pay' analyses that American society is willing to pay an average of $1.2 million for each prevented gun injury (Ludwig and Cook, 2001).

Perhaps the most significant federal effort toward gun control was the passage of the Brady Handgun Violence Prevention Act, signed into law on November 30, 1993, which mandated background checks and a waiting period on individuals who attempted to purchase firearms (Anon, 1993). Prior to this only 18 states already had an existing mechanism of background checks before a firearm purchase was in place (General Accounting Office, 1996). The permanent provisions of the legislation led the U.S. Attorney General to create the National Instant Criminal Background Check System (NICS) (Federal Bureau of Investigation (FBI), 2009), a computerized system that combines records provided by local, state, and federal agencies, and helps determine eligibility of a prospective gun purchaser via a swift background check (Federal Bureau of Investigation (FBI), 2009). However, supply of records to the NICS is voluntary and pursuant to law in each state (Regional Justice Information Service, 2005) and there exists substantial variability in state laws on the different categories of prohibitory records that are included in the background checks — such as criminal history, restraining orders, mental illness, fugitive status and misdemeanors.

Researchers have long been interested in the links between policies on gun availability or gun restrictions and violent crime, though results have frequently been mixed. One early study using 1980 data on several U.S. cities found little association overall between gun restrictions and violent crime (Kleck and Patterson, 1993). More recent studies have suggested that more permissive state laws on concealed handgun carrying are linked to increased homicides (Ludwig, 1998; Rosengart et al., 2005), that the Brady Act reduced firearm suicides among older adults but otherwise did not have substantial impact on firearm deaths (Ludwig and Cook, 2000), that child access prevention gun laws reduce youth suicide (Webster et al., 2004), that minimum purchase age and possession age laws appear to have little effect on firearm deaths (Rosengart et al., 2005; Webster et al., 2004) and that firearm death rates may differ for states with background checks by federal agencies versus state or local agencies (Sen and Panjamapirom, 2011; Sumner et al., 2008). To our knowledge, there is no research on whether the inclusion of different types of prohibitory records in the state's background check process is associated with firearm deaths at the state level.

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It may be hypothesized that having more background checks overall will reduce the risks of guns falling into 'wrong hands', thereby reducing gun violence. It is also possible that different types of background checks will differentially impact homicides versus suicides. Finally background checks that increase the 'cost' of gun purchase may simply lead to a substitution into other methods of violence, so that reductions in homicide and suicide deaths by gun are largely off-set by increases in homicide and suicide deaths by other methods.

Methods

We use cross-sectional time-series data at the state level for the U.S. from 1996 to 2005.

Outcome variables

The main outcome variables in this study are the total number of homicide-deaths and suicide-deaths caused by firearms, which were retrieved from the Web-based Injury Statistics Query and Reporting System (WISQARS™), Centers for Disease Control and Prevention (CDC) (2008). Legal intervention homicide-deaths were excluded from the analyses. WISQARS data are compiled from death certificate data from the National Vital Statistics System. They are free and publicly available, and have been deemed 'not human subject' research by the Institutional Review Board of the lead author's university.

Main policy variables

The main independent variable is the type of background information that the state uses to perform background checks of persons attempting to purchase a gun. Every state checks for criminal history (which is the reference category). Additionally, some states check additional information, such as restraining orders, mental illness, fugitive status and misdemeanor records. We retrieved the data on the type of background information from the Survey of State Procedures Related to Firearm Sales from the Bureau of Justice Statistics (Regional Justice Information Service, 1997, 1998, 2000, 2001, 2002, 2003, 2004, 2005, 2006). The survey was conducted yearly from 1996 to 2005, hence these are the years included in our study. The survey was not conducted in 1998 (L. Gallaway, personal communication, July 11, 2008), and is not available after 2005. The definitions of these prohibitory records are provided in Appendix A. We conduct our analysis in two ways. First, we create an additive index of the number of background checks a state has in place. Next, we include separate binary indicators for whether the state checked background information on 'restraining orders', 'mental illness', 'fugitive status', 'misdemeanor' and 'other miscellaneous records' (such as DUI convictions) in a given year — with the reference category being checking for criminal history only.

Lagged value of outcome variables

Stricter state background checks may be in response to a prior history of gun violence. Alternatively, stricter state background checks may reflect a long history of support for gun control, even if historic gun violence rates are low. Failure to account for this may produce biased estimates of the relationship between background information checks and firearm violence. We use an approach advocated by Wooldridge (2006), where a value of the outcome variable from an earlier year is included in the regression equation to help reduce such estimation bias.

Other control variables

We control for various state-level variables that could potentially predict the prevalence of violent deaths in the state. Particularly importantly, we include a binary control for whether the state had a policy of doing background checks for gun purchases *prior* to the passage of the Brady Act (Ludwig and Cook, 2000). Firearm violence is committed not just with guns acquired recently but also with guns that were purchased in the past. It is likely that states with background checks preceding the Brady Act would have fewer 'guns in dangerous hands' already in circulation, since felons and other criminals would have been prevented from legally purchasing guns for a longer period of time. Thus, this variable may serve as an indicator of how many guns purchased with no background checks are already in circulation.

Other state-level controls include the state's annual per-capita-income (measured in thousands of dollars), poverty-rate, unemployment-rate, divorce-rate, per-capita alcohol-consumption, police officers per 100,000 residents, and the percentage of the state's population aged 16 and over who were hunters. We control for whether the state employs the federal agency (FBI) to conduct background checks, as past research suggests this may be important (Sen and Panjamapirom, 2011; Sumner et al., 2008). We include binary indicators for each year in our data, to account for temporal shifts in factors that are relevant to the whole country — such as business cycles that impact the whole economy. Finally, we include binary controls for the nine census sub-regions, to account for unmeasured socio-cultural-demographic commonalities within each sub-region that potentially correlate to both the state gun laws and the outcome variables for states in that sub-region.

The source of income data was the Regional Economic Information System, Bureau of Economic Analysis, U.S. Department of Commerce (Bureau of Economic Analysis, 2008). Poverty rates were retrieved from Housing and Household Economic Statistics Division, U.S. Census Bureau (Housing and Household Economic Statistics Division, 2008). Unemployment data were retrieved from the Local Area Unemployment Statistics Information and Analysis, U.S. Bureau of Labor Statistics (2008). The sources of divorce data included the Division of Vital Statistics, National Center for Health Statistics, CDC (National Center for Health Statistics, 2008). The per capita alcohol consumption data were retrieved from the National Institute on Alcohol Abuse and Alcoholism (National Institutes of Health, 2008). Officers per 100,000 residents were from the Disaster Center (The Disaster Center, 2009). Percentage of population over 16 years who were hunters was obtained from the 2001 National Survey of Fishing, Hunting and Wildlife Associated Recreation (DeCicca et al., 2008).

Analysis of all homicide and suicide deaths

If background check policies largely lead to a substitution to other methods of inflicting violence, then background check policies will be associated with fewer violent deaths from guns, but will not be associated with any reductions in overall violent deaths. To explore this, we also estimate the association between background check policies and all homicide and suicide deaths, not just those caused by guns.

Statistical analyses

Suicide and homicide incidents are not normally distributed and always take integer values. Therefore, we use negative binomial regression models to evaluate the relationship between the type of background checks and states' suicide and homicide-deaths caused by firearm. In addition to all the control variables described in the previous section, we include the state's population size with its coefficient constrained to be 1. Robust standard errors are calculated. The statistical software STATA version 11 is used. Statistical significance is reported at the 0.05 level and the 0.10 level, with the latter deemed as 'marginally significant.'

Results

Table 1 describes the proportion of states with specific background checks at 3 points of time over the study period, as well as the average number of restrictions per state and per sub-region at those same points in time. The number of restrictions increases over time, as do the proportion of states adopting each background check. Differences by sub-regions are seen. For example, in any time period, among all sub-regions the New England sub-region has the most restrictions, while the East South Central sub-region has the fewest.

Table 2 shows the adjusted incidence rate ratio (IRR) from negative binomial models. The first set of results is for firearm homicide and suicide deaths using the index of number of background checks. The next set includes separate binary indicator for each background check. The final set of results uses all homicide and suicide deaths as the outcomes.

Results from using the index show that an additional background check is associated with fewer firearm homicide (IRR: 0.93, 95% CI:

Table 1
Background checks prior to gun purchase at state-level over 1996–2005.

Fraction of states with specific restrictions or number of restrictions at beginning, middle and end of study period			
	1996	2001	2005
Criminal record	0.98[a]	1	1
Restraining order	0.64	0.74	1
Mental illness	0.32	0.34	0.76
Fugitive	0.90	0.88	0.92
Misdemeanor	0	0.66	0.88
Other miscellaneous	0.58	0.78	0.76
Number of restrictions per state	2.4	3.4	4.3
Sub region: East North Central	2.8	3.8	4.2
Sub region: East South Central	1.5	2.25	3.75
Sub region 3: Middle Atlantic	3	4	4.33
Sub region 4: Mountain	1.87	2.75	4.12
Sub region 5: New England	3.17	4.17	4.67
Sub region 6: Pacific	2.8	3.8	4.4
Sub region 7: South Atlantic	2.75	4.12	4.5
Sub region 8: West North Central	2.43	3.14	4.43
Sub region 9: West South Central	1.5	2.5	4.25

Notes: this is a state-level study for the U.S. from 1996 to 2005. State policies on background checks are obtained from survey of state procedures related to firearm sales, the Bureau of Justice Statistics.
The nine sub-regions are: East North Central (OH, IN, IL, MI, WI), East South Central (KY, TN, AL, MS), Middle Atlantic (NY, NJ, PA), Mountain (MT, ID, WY, CO, NM, AZ, UT, NV), New England (ME, NH, VT, MA, RI, CT), Pacific (WA, OR, CA, AK, HI), South Atlantic (DE, MD, DC, VA, WV, NC, SC, GA, FL), West North Central (MN, IA, MO, ND, SD, NE, KS) and West South Central (AR, LA, OK, TX).
[a] Only Mississippi had no record for criminal history background check in 1996. They started checking from 1997.

0.91–0.96) and suicide deaths, though the latter is only marginally significant (IRR: 0.98, 95% CI: 0.96–1.00). Results from using binary indicators for each background check show that compared to states checking for criminal history only, firearm homicide deaths appear lower in states checking for restraining orders (IRR: 0.87, 95% CI 0.79–0.95) and fugitive status (IRR: 0.79, 95% CI 0.72–0.88). Checking for mental illness is associated with fewer deaths, but is only marginally significant (IRR = 0.93, 95% CI 0.87–1.01).

Compared to states checking for criminal history only, firearm suicide deaths are lower in states checking for mental illness (IRR = 0.96, 95% CI 0.92–0.99), fugitive status (IRR: 0.96, 95% CI 0.90–0.99), and misdemeanors — though the last is only marginally significant (IRR = 0.95, 95% CI 0.92–1.00). The only background check law that has an unexpectedly positive and significant association with firearm deaths is other miscellaneous background checks, which is significantly associated with more firearm homicides (IRR = 1.12, 95% CI 1.03–1.22). Having background checks in the pre-Brady period is strongly associated with reductions in both firearm homicide (IRR: 0.88, 95% CI 0.81–0.96) and suicide deaths (IRR 0.87, 95% CI 0.83–0.91).

With respect to all homicide and suicide deaths, policies associated with fewer violent deaths from firearms are for the most part also associated with fewer overall violent deaths. Specifically, checking for restraining orders (IRR = 0.91, 95% CI 0.85–0.98), fugitive status (IRR = 0.77, 95% CI 0.71–0.84) and mental illness (IRR = 0.93, 95% CI 0.86–0.99) are associated with fewer overall homicide deaths; checking for mental illness (IRR 0.97, 95% CI 0.95–0.99) and fugitive status (IRR 0.91, 95% CI 0.87–0.95) are associated with fewer overall suicide deaths. Thus, there is little evidence to suggest that increasing the cost of accessing firearms by imposing additional background checks simply makes perpetrators substitute to other methods of committing homicides or suicides. Results for other control variables in the models are not discussed due to space limitations.

Discussion and conclusion

The topic of gun control remains in dispute among U.S. policy-makers, though it is generally accepted that it is best to keep guns out of the hands of those whose main inclination is to use them to inflict harm upon themselves or others. The question remains about what methods might be best to attain that end.

This current study explores the relationship between state level laws on types of background checks and gun-related homicide and suicide deaths in the state. We use data from 1996 to 2005, which is primarily dictated by the years of availability of the annual Survey of State Procedures Related to Firearm Sales. We conduct our analysis first using an index of the number of background checks a state requires, then including binary controls for specific types of restrictions. On balance, our evidence suggests that having more background checks is associated with declines in firearm deaths. Specific checks for

Table 2
Adjusted IRR from negative binomial models for firearm homicide and suicide and all homicide and suicides.

Variables	Firearm homicide	Firearm suicide	Firearm homicide	Firearm suicide	All homicide	All suicide
Index of background check laws	0.93** (0.91–0.96)	0.98* (0.96–1.00)				
Restraining order[a]			0.87** (0.79–0.95)	1.03 (0.98–1.09)	0.91** (0.85–0.98)	1.02 (0.98–1.06)
Mental illness[a]			0.93* (0.87–1.01)	0.96** (0.92–0.99)	0.93** (0.86–0.99)	0.97** (0.95–0.99)
Fugitive[a]			0.79** (0.72–0.88)	0.95** (0.90–0.99)	0.77** (0.71–0.84)	0.91** (0.87–0.95)
Misdemeanor[a]			0.99 (0.90–1.08)	0.95* (0.92–1.00)	1.02 (0.95–1.10)	0.98 (0.95–1.02)
Other Miscellaneous[a]			1.12** (1.03–1.22)	1.01 (0.97–1.05)	1.05 (0.98–1.13)	1.00 (0.97–1.03)
Income	1.02* (1.00–1.05)	0.98** (0.97–0.99)	1.03* (1.01–1.22)	0.98** (0.97–1.00)	1.03* (1.01–1.06)	0.98** (0.97–0.99)
Poverty rate	0.98** (0.96–0.99)	0.99** (0.98–0.99)	0.98** (0.96–0.99)	0.99** (0.98–0.99)	0.99 (0.98–1.01)	0.99** (0.98–0.99)
Unemployment rate	1.14** (1.08–1.19)	1.01 (0.98–1.03)	1.15** (1.09–1.20)	1.01 (0.98–1.03)	1.09** (1.05–1.13)	1.01 (0.99–1.02)
Per capita officers	1.00 (0.99–1.01)	0.99** (0.98–0.99)	1.00 (0.99–1.01)	0.99** (0.98–0.99)	1.00 (0.99–1.01)	0.99** (0.98–0.99)
Divorce rate	1.07** (1.03–1.10)	1.03** (1.01–1.05)	1.07** (1.03–1.11)	1.03** (1.01–1.05)	1.05** (1.02–1.08)	1.04** (1.02–1.05)
Per capita alcohol consumption	0.91* (0.84–1.00)	1.03 (0.98–1.07)	0.95* (0.87–1.04)	1.04 (0.99–1.08)	1.01* (0.94–1.07)	1.08 (1.04–1.11)
1990 homicide or suicide rate	1.13** (1.11–1.14)	1.08** (1.07–1.09)	1.13** (1.11–1.14)	1.08** (1.07–1.09)	1.10** (1.09–1.12)	1.03** (1.02–1.04)
Federal agency	0.95 (0.87–1.04)	1.04* (0.99–1.09)	0.96 (0.87–1.06)	1.02 (0.97–1.07)	1.01 (0.93–1.10)	1.02 (0.98–1.05)
% Population over 16 years who are hunters	0.99** (0.98–0.99)	1.01** (1.005–1.01)	0.99** (0.98–0.99)	1.01** (1.005–1.01)	0.99* (0.98–1.01)	1.01** (1.006–1.01)
Pre-Brady background check policy	0.87** (0.80–0.95)	0.88** (0.84–0.92)	0.88** (0.81–0.96)	0.87** (0.83–0.91)	0.92** (0.86–0.98)	0.97* (0.94–1.00)

Data used is cross-sectional time-series data at the state level for the U.S. from 1996 to 2005, with year 1998 omitted due to lack of information on state laws. N = 450.
Numbers shown in the tables are IRR (95% C.I.).
All models control for year and census sub-region fixed effects. All models include the state population, with its coefficient constrained to be 1. Robust standard errors are calculated.
* $p<.10$.
** $p<.05$.
[a] The reference category is just criminal background check.

restraining orders, fugitive status, mental illness and misdemeanors are each associated with declines in firearm deaths, as well as all homicide and suicide deaths. Only in case of 'other miscellaneous' checks is a counterintuitive positive association found with homicide deaths, though this may be an artifact of the imprecise nature of the variable, since it includes eclectic restrictions that are not clearly categorized in the Survey of State Procedures. States with background checks prior to the Brady Law have fewer homicide and suicide deaths, which may be because those states have fewer guns purchased in the past with no background checks currently in circulation.

The findings of this study tentatively suggest that, by and large, more comprehensive background checks at the state level prior to firearm purchases may reduce firearm deaths. However, we strongly emphasize that these results are preliminary, and that more research is needed to establish whether these results are causal. Specifically, there are several underlying confounders that this study cannot account for. These include how efficiently background checks are conducted in different states; whether prohibitory records are maintained in a general law enforcement database or a specialized database, available electronically or on paper, and the quality of the records. It is recognized that "the effectiveness of background checks is affected by the degree of automation involved, the types of prohibitory records available, and the extent to which the records are complete" (Regional Justice Information Service, 2005, p.12). Other potential confounders include factors like cross-border smuggling of guns, ease of illegal acquisition of firearms in black markets (Atwell, 1999; Trace the Guns Report, 2010), existence of unaccountable transfers of firearms between gun dealers and traffickers (Fallis, 2010), popularity of gun shows — where there is often a lack of background checks during purchases, and how a state regulates gun transactions in the secondary market (Open Society Institute, 2000). It is anticipated that this study will lead to further research that incorporates those factors.

Conflict of interest statement

The authors declare there are no conflicts of interest in this research.

Appendix A. Definitions of prohibitory records

Type of prohibitory record	Definition[a]
Criminal history	All states maintain a central repository with criminal history records that include, at a minimum, felony arrests and dispositions. The first entry for a subject is normally an arrest record supported by fingerprints. Subsequent dispositions that may be recorded include dismissals of charges, guilty pleas, convictions, acquittals, admissions to and discharges from correctional facilities, and probation and parole events. Criminal history repositories also record modifications such as an expungement or a set aside of a conviction, a pardon, or a restoration of civil rights. Agencies that submit records to the repositories include police and sheriffs' departments, courts, prosecutors, jails, and prisons. State criminal record systems differ in regard to procedures, the extent of automation, and the completeness and accessibility of the data. All states in our study checked criminal history records with the exception of Mississippi in 1996.
Restraining order	An order that restrains acts of domestic violence or other unlawful conduct is issued by a judge and usually entered by court or law enforcement personnel into a state system or NCIC or both.
Mental illness	Federal and state prohibitions encompass a variety of civil court orders, including a commitment to a mental hospital and a finding that a person is incompetent to manage his or her affairs. A prohibition may also be caused by a disposition in a criminal prosecution, such as a finding of incompetence to stand trial or a verdict of not guilty by reason of insanity. A criminal case disposition is usually reported by the trial court to the state's central records repository. Civil commitment records are often protected from disclosure by privacy laws.
Fugitives	The Federal Gun Control Act (GCA), at 18 U.S.C. 921 (a) (15), defines "fugitive from justice" as any person who has fled from any state to avoid prosecution for a crime or to avoid giving testimony in a criminal proceeding. Most states apply a similar definition and some limit the prohibition to persons who are wanted for certain types of offenses.
Misdemeanors	The types of misdemeanor-level offenses included in prohibitory statutes vary widely. Federal law and a few state codes only prohibit a misdemeanor offender who has been convicted of an act of domestic violence (generally, an assault against a spouse, an intimate partner, or a child). Several other states deny a misdemeanor offender who has been convicted of any crime of violence or a firearm offense. Requirements for misdemeanor offenders to regain firearm rights after a conviction are generally less stringent than those for felons. A few states disqualify persons who have been arrested for or charged with certain misdemeanors.

[a]Survey of state procedures related to firearm sales, midyear 2004.

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