The Effectiveness of Gun Control Laws:

Multivariate Statistical Analysis

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ASTRACT.   The purpose of this study is to statistically and empirically evaluate the effectiveness of the *gun control laws* that have been adopted by states and municipalities. States are divided into two groups: states with no restrictions as to gun use and states with restrictions (*e.g.,* waiting periods, license, etc.). Multiple linear regression models are used to evaluate the relationship between the number of gun related *deaths* in 1990 and sets of determinants which include state laws and regulations governing the use of *firearms.* The study results indicate that gun control laws have a very mild effect on the number of gun related deaths while socioeconomic variables such as a state's *poverty* level, *unemployment* rate and *alcohol* consumption, have significant impact on firearm related deaths. These findings suggest that any reduction in resources spent on *social programs* tied to the *Crime Bill* may be counter-productive.

I

Research Background

THERE ARE ALMOST 20,000 LAWS AND REGULATIONS in this country which attempt to contain the use of firearms. Nevertheless, the number of deaths associated with gun related activity reached almost 40,000 in 1992, almost surpassing the number of fatalities associated with automobile accidents (Ruffenach, 1994). The ever increasing numbers of firearm deaths have led to emotional pleas for stiffer gun control laws and regulations. Gun related fatalities have also led to reevaluations of the relationship of firearm deaths and medical implications by the members of the medical community . The concern of the medical community has helped to move the debate from a strict focus on the Second Amendment issue to health implications (Kellermann et.al., 1993).

In spite of charged emotional debates and passage of numerous laws and regulations, no empirical studies have been done to evaluate the effectiveness of gun control laws in this country. The debate on the Brady Bill could have been better informed by scientific research. Nevertheless, an investigation of

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the relationship between the number of deaths associated with firearms and gun control laws can be valuable as our society further attempts to fine-tune laws and social programs. The purpose of this study is to investigate the effectiveness of laws and regulations prior to the passage of the Brady Bill in 1992. A multivariate statistical technique is proposed to establish the relationship between the number of gun related deaths by states and sets of determinants including state laws and regulations on firearm use.

In spite of numerous laws and regulations on gun control, the results are relatively unimpressive (Wright, 1988). Kellermann et. al (1993) argues that the presence of a firearm in the home increases the likelihood of a gun fatality. They maintain that people who become gun fatalities also experienced alcohol, drug abuse and domestic violence at much greater rates than the national average. Their conclusion, that gun ownership increases the odds of being killed, may be debatable given these complicating factors.

Kleck and McElrath, for example, report that when firearms are present (they) "appear to inhibit attack and, in the case of an attack, to reduce the probability of injury (to victims) , whereas, once an injury occurs, they appear to increase the probability of death." (1991:669). Their study, which uses a hierarchy of violence, concludes that the presence of a firearm has a deterrent effect and the availability of firearms does not increase one's likelihood of being killed.

One of the benefits often cited by those favoring waiting periods in buying a gun is that of reducing the incidence of so-called "crimes of passion." The prevailing logic is that a waiting period will deny irrational perpetrators access to the means (guns) for violent action and engender a "cooling off period." Under normal circumstances, people, especially those who would commit a crime out of passion, would not be willing to pay a price for the crime. In the heat of the moment, however, a perfectly inelastic demand curve for murder exists—the person is "in the market," at least momentarily (Hellma, 1980, 122).

Studies of the effectiveness of gun control laws and regulations must not ignore other pertinent variables that may contribute to committing crimes, especially socioeconomic variables. Excluding these important variables from the model building process, and claiming that gun control laws and regulations are solely responsible for any change in crime rates, is too simplistic. Mauser and Holmes (1992) investigated the effectiveness of the 1977 Canadian gun control law. The linear model which they developed included comprehensive socioeconomic attributes such as the unemployment rate, immigration laws and alcohol consumption. Their findings suggest that the availability of firearms may not be as important a factor in homicide rates as many believe. According to their study, other socioeconomic factors, such as the unemployment rate, may

have played a significant role in determining homicide rates. They suggest that socially disenfranchised groups (*e.g.,* minorities, youth, unemployed, alcoholics) face serious social problems. Until these problems are addressed successfully "these groups will undoubtedly continue to contribute disproportionately to the homicide rate" (1992:613).

A relationship between unemployment and criminal violence has been relatively well documented (Lofftin et.al., 1989; Parker, 1989; Vold, 1986). A relationship between ethnic group membership and criminal violence has also been established (Gurr, 1981; Lane, 1968; Lenton, 1989; Monkonnen, 1989; Williams, 1984), although this may, in fact, be due to structural poverty.

Another factor often discussed in crime studies is the impact of transients who move into urbanized areas in search of job opportunities. Jarrell and Howsen (1990) argued that job opportunities created in urban areas attract strangers which may, in turn, create a climate conducive of crime. According to their study, increased urbanization likely will be met with increased crime levels. Also in urbanized areas, violence by youth has received special attention. A study shows that the offenders appear to be getting younger (Steffensmeir et.al., 1989). Finally, numerous studies have linked alcohol consumption to homicide (Gary, 1986; Jarrell and Howsen, 1990; Kellermann et.al., 1993).

II

Study Method and Data

THE DEPENDENT VARIABLE in this study is firearm deaths per 100,000 population in a state (includes unintentional deaths, homicide, suicide and those of unknown intent) (DEATH). Several independent variables will be used in this study based on the literature review. The unemployment rate (UNEMPLOYED) is known to have a positive relationship with gun related fatalities (Parker, 1989). We expect a positive relationship between this variable and the dependent variable. According to previous studies, especially Mauser and Holmes (1992), the poverty level (POVERTY) also plays a significant role in gun related fatalities. A positive relationship between these two variables is, therefore, expected. Gary (1986), Jarrell and Howsen (1990) and Kellermann et.al., (1993) also suggest a positive relationship between per capita alcohol consumption (ALCOHOL) and gun related fatalities. The percentage of the population in a state that lives in urbanized areas (URBAN) is included in the model to capture whether so-called "urban violence" is a significant factor in determining the number of fatalities caused by firearms. A positive relationship is also expected between these two variables. According to studies by Mauser and Holmes (1992) and Steffensmeier et.al., (1989), the population group between the ages of 18 and

24 (AGE1824) appears to become involved in more gun related violence than the rest of the population. This study, therefore, hypothesizes a higher incidence of gun related deaths in states where this group is a larger portion of the total population. States with a higher than the national average population of Asians (ASIAN = 1), African-Americans (BLACK = 1) and Hispanics (HISPANICS = 1) will be included in the estimating models to capture the relationship of ethnic differences to gun fatalities. Although a positive relationship was revealed between these variables in the Mauser and Holmes study, the directional relationship is uncertain in this study given cultural differences between population in Canada and the United States. Finally, a dummy variable for state laws regarding firearm possession is used to evaluate the effectiveness of the gun control laws. It is hypothesized that states with some type of restrictive laws and regulations (LAW = 1) will have a lower gun related death rate than those states without such laws and regulations (LAW = 0).

Data for this study was obtained from recently published sources. *Advance Data* (January 27, 1994) from the Vital and Health Statistics of the Center of Disease Control and Prevention, National Center for Health Statistics, was the source for firearms death rate data. Poverty rates, unemployment rates, level of urbanization, and population densities were found in *the Statistical Abstract of the United States (1993). The Eighth Special Report to the U.S. Congress on Alcohol and Health (1993)* provided rates of per capita alcohol consumption. Finally, the Dec. 20, 1993 issue of *Time Magazine* provided the information on state gun control laws. While in his report Lacayo divided the country into three groups: states with no restrictions, states with waiting periods only, and states with waiting periods and licensing requirements; the present study combines the last two groups into a single category. Washington, DC is excluded from this study. Preliminary findings indicate that Washington DC is an extreme outlier in terms of most of the variables in the model. Inclusion of Washington, D.C., could, therefore, distort the statistical results making it harder to develop a true picture of relationship between firearm deaths and the hypothesized sets of determinants.

Initially simple descriptive statistics (mean and standard deviation) of variables will be presented. A univariate t-test between two groups (LAW = 1 and LAW = 0) will be attempted to evaluate whether any significant differences in the independent variable are noted relative to these two groups. Multivariate linear regression models will be constructed to evaluate the effectiveness of gun control laws and regulations (LAW) relative to the other independent variables. Variance inflation factors (VIF) will be estimated to ascertain whether multicolinearity is present.

III

Results and Implications

TABLE 1 presents descriptive statistics on all variables. Twenty-four states as of 1990 did not have any gun control laws and regulations while 26 states had some type of regulation. The average firearm deaths per 100,000 population for states which had some type of gun control laws and regulations was 19.6 as opposed to 24.4 for those states which did not ($p = 0.043$). The unemployment rate ($p = 0.058$) and poverty level ($p = 0.002$) for states without gun control laws and regulations were slightly higher than in those with such laws and regulations. There was no difference in alcohol consumption between these two groups of states ($p = 0.779$). Young people make up a considerably higher portion of the population in states with gun control laws and regulations than of the states without such laws ($p = 0.025$). More people live in urbanized areas in states with gun control laws and regulations than in states without such laws ($p = 0.011$). Finally, a larger proportion of Asians and African-Americans appear to reside in states with such laws and regulations but more Hispanics are found in states without such laws and regulations, however, the differences are not statistically significant.

Table 2 reveals the results of three multivariate linear regression models; the overall model ($n = 50$), the model for states with some types of laws and reg-

Table 1

Descriptive Statistics and t-values

Variables	States with Laws (LAW=1; n=26)		States without Laws (LAW=0, n=24)		t-values
	Mean	SD	Mean	SD	
DEATHS (per 100,000)	19.58	7.80	24.44	8.71	2.08b
UNEMP (%)	5.07	1.13	5.66	1.02	1.95
POVERTY (%)	11.40	2.70	14.87	4.71	3.17a
URBAN (%)	73.14	11.76	62.80	15.82	2.64a
ALCOHOL(Per capita)	2.42	0.33	2.47	0.80	0.29
AGE1824(1000)	692.96	40.28	344.37	404.74	2.28b
ASIAN(%)	0.27	0.45	0.08	0.28	1.76
AFRO-AM.(%)	0.42	0.50	0.25	0.44	1.29
HISPANICS(%)	0.15	0.37	0.21	0.42	0.49

a $p < 0.01$, b $p < 0.05$

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Table 2
Regression Results

(Dependent Variable Number of Firearm Death per 100,000 Population)

Variables	Overall Regression coefficients	t-values	With Laws Regression coefficients	t-values	Without Laws Regression coefficients	t-values
Constant	-14.599	1.503	-22.649	1.698	-1.159	0.072
LAW	-2.844	1.356	NA	NA	NA	NA
UNEMP	0.614	0.722	2.149	1.591	-0.143	0.116
POVERTY	1.347	4.340a	0.892	2.357b	1.367	2.345b
URBAN	0.071	0.880	0.240	2.408b	0.055	0.261
ALCOHOL	3.779	2.052b	2.178	1.059	-1.874	0.431
AGE1824	0.002	1.211	-0.003	1.009	0.007	2.914a
ASIAN	2.982	1.172	8.937	1.748c	-0.817	0.237
AFRO-AM.	5.482	2.882a	8.862	2.772a	6.949	3.320a
HISPANICS	3.174	1.004	-3.008	0.771	-6.628	1.541
R^2	0.657		0.832		0.765	
F-value	8.510a		9.301a		6.914a	

a $p < 0.01$, b $p < 0.05$, c $p < 0.10$
NA = Not Applicable

ulations on gun controls (n = 26), and the model for the rest of the states (n = 24). All models appear to be adequate with an R^2 of at least 0.657 for the Overall model and an F = 6.91 (p = 0.000) for the model for states without any gun control laws or regulations. No serious multicolinearity is noticed (all VIFs > 10, not shown here). All variables in Overall Model behave as we hypothesized. The gun control laws/regulations appear to be related to a reduced number of firearm deaths. According to the model, states with gun control laws had almost 3 fewer deaths per 100,000 population than states without any such laws. The relationship, however, is not statistically significant.

The results indicate that the most important variables with respect to numbers of firearm deaths are socioeconomic variables, especially the poverty level (p = 0.000), the racial mix (African-Americans, p = 0.006) and alcohol consumption (p = 0.046). It is interesting to note that states with a higher than national average Hispanic population have a lower number of firearm deaths while the opposite is true for the states with a higher than national average Asian and/or African-American population. The size of the young adult population (AGE1824) and the percentage of the population residing in urbanized areas (URBAN) appear to play only minor roles in this model. The insignificant relationship

between the unemployment rate and the number of firearm deaths was unexpected. The probable cause for such a low relationship may be a multicolinearity between the unemployment and poverty levels. A model without the poverty variable (not shown here) did indeed force the unemployment variable to assume a larger role (p = 0.025) .

Other regression models produced no surprising results. It is evident, based on these three models, that the poverty level (p < 0.05) and racial mix, African-Americans (p < 0.01), are the two leading attributes related to gun fatalities. The young adult population appears to be a major factor in firearm deaths in states without gun control laws, whereas the proportion of the population residing in urban area seems to be a major factor in gun related fatalities in states with gun control laws.

The multivariate regression results indicate that gun control laws and regulations do appear to have some impact on reducing the number of deaths associated with the firearms. However, this relationship is not as strong as the one found by Mauser and Holmes (1992). The main reason for difference in findings between this and the earlier study may rest with the characteristics of the laws themselves. The 1977 Canadian law is a federal regulation governing the use of firearms whereas the laws and regulations used in this study are state laws which vary widely between. Accordingly, the results from this study may not be as clear and strong as the results found by the Mauser and Holmes' study. Another reason for the difference of the results between this and the earlier study may be due to a difference of culture between this country and Canada as to the perception of "violence." A study by Jones et al. on violence in the national hockey league, for example, appears to indicate a significant and positive relationship between aggregate measures of violence and attendance for games played in both American and Canadian cities; but "there is a significant positive relationship between the more extreme forms of violence (proxied by majors and misconduct) and attendance only in American cities." (1993:63) (emphasis is original). Finally, we in this country may not be doing as good a job of educating youngsters as is done in Canada. According to our model, a statistically significant positive relationship exits between firearm related fatalities and the size of the age 18-24 (p = 0.0+) population in states without any gun control laws or regulations. Proper education on the value of life and the criminal implications of gun violence may help discourage gun related violence.

This study supports the results of the studies by Gary (1986), Jarrell and Howsen (1990) and Kellermann et.al., (1993), that alcohol consumption is an important determinant of firearm deaths. Although the relationship was not as strong as expected, this study confirms that higher alcohol consumption is related to increased firearm death rates.

As expected, a strong relationship between poverty levels and firearm deaths was also found, confirming the findings of earlier studies by Lofftin et. al., (1989), Parker (1989), and Vold (1986). There are, of course, many possible explanations for this particular relationship which include reactions to the increased stresses of living in poverty, higher crime rates in depressed areas, and a possible inclination to turn to crime—including violent crime—as a response to a situation of hopelessness, to name just a few.

The status of minority groups in a society played a significant role in determining the number of firearm deaths in Mauser and Holmes study (1992). This study appears to partially support such findings. According to this study, states with a higher than national average African-American population appear to have more firearm deaths than the rest (p = 0.006) and similar results, although less strong, are noted for the states with a higher than national average Asian population (p = 0.248). The relationship between these ethnic groups and the number of firearm deaths needs, however, a cautious interpretation. Although the relationship between ethnic groups and criminal violence has been well established (Gurr, 1981; Lane, 1968; Lenton, 1989; Monkonen, 1989; Williams, 1984), this may be due to structural poverty experienced by many African-American and Asian communities and especially by the refugees from Southeast Asian countries. For example, almost 20% of the Asian/Pacific American families of married couples with children under 5 years old have an income level below the poverty level (Kwon and Bae, 1995). The overall U.S. average of people living below the poverty level in 1989 was 12.4%.

IV

Conclusions

THIS STUDY examined the effectiveness of gun control laws and regulations using state level data. The multivariate statistical regression model suggests that the existence of gun control laws indeed have a deterrent effect on firearm deaths, although this relationship is weaker than previously reported. If, however, the United States had had a uniform gun control law similar to the 1977 Canadian law, the impact may have been stronger than that found here, which relies on systems of laws that vary significantly between states. Accordingly, it appears that the Brady Bill, if implemented properly, may have significant impact on deterring the number of deaths associated with the firearm use.

However, and more important, this study also shows that the major association for firearm fatalities is with socioeconomic factors such as poverty levels and alcohol consumption. Unless this country directs its efforts toward the socioeconomic ills which appear to bear the strongest relationship to violent deaths

by firearms, the fatalities likely will remain high whether this country has gun control laws or not.

These findings may make sense when we consider that systems of laws with their consequent punishments are, essentially, negative approaches to behavior modification. While such systems of control are necessary, sociologists and psychologists as well as management scholars have, for several decades, noted that *positive approach to motivating people toward desired ends tend to be much more effective than punishment.* While reducing violence in society is most certainly not fully analogous to the problems of motivating employees (nor as simple), the lessons learned about improving the conditions in which people must operate and, if possible, identifying and tying valued rewards to desired actions, may well be applicable here. If crimes of passion are, as many experts claim, often motivated by hopelessness, then efforts to reduce or even eliminate the hopelessness sources of such—and perhaps even provide reason for hope— are likely to have a positive impact. The results of the current study, which indicate that *poverty and alcohol consumption are more closely linked to levels of firearm deaths than is absence or presence of gun control laws,* provide support for this line of thinking. The results of this study suggest, therefore, that resources may be more effectively used if directed toward social and economic programs rather than toward systems of regulation and punishment that may simply seek to place restrictions on someone they already feels they have nothing to gain from social compliance, and nothing more to lose.

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Compassionate Wisdom

FAMINE OCCURS as a result of greed, pestilence as a result of stupidity, and warfare as a result of anger.

. . . a poor man cannot earn a penny just by counting his neighbor's wealth, even if he does so day and night.

NICHREN

Lighting One Candle

NEVER DOUBT that a small group of thoughtful, committed citizens can change the world; indeed, it's the only thing that ever does.

MARGARET MEAD