

Gun Ownership and Firearm-related Deaths

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ABSTRACT

BACKGROUND: A variety of claims about possible associations between gun ownership rates, mental illness burden, and the risk of firearm-related deaths have been put forward. However, systematic data on this issue among various countries remain scant. Our objective was to assess whether the popular notion “guns make a nation safer” has any merits.

METHODS: Data on gun ownership were obtained from the Small Arms Survey, and for firearm-related deaths from a European detailed mortality database (World Health Organization), the National Center for Health Statistics, and others. Crime rate was used as an indicator of safety of the nation and was obtained from the United Nations Surveys of Crime Trends. Age-standardized disability-adjusted life-year rates due to major depressive disorder per 100,000 inhabitants with data obtained from the World Health Organization database were used as a putative indicator for mental illness burden in a given country.

RESULTS: Among the 27 developed countries, there was a significant positive correlation between guns per capita per country and the rate of firearm-related deaths ($r = 0.80$; $P < .0001$). In addition, there was a positive correlation ($r = 0.52$; $P = .005$) between mental illness burden in a country and firearm-related deaths. However, there was no significant correlation ($P = .10$) between guns per capita per country and crime rate ($r = .33$), or between mental illness and crime rate ($r = 0.32$; $P = .11$). In a linear regression model with firearm-related deaths as the dependent variable with gun ownership and mental illness as independent covariates, gun ownership was a significant predictor ($P < .0001$) of firearm-related deaths, whereas mental illness was of borderline significance ($P = .05$) only.

CONCLUSION: The number of guns per capita per country was a strong and independent predictor of firearm-related death in a given country, whereas the predictive power of the mental illness burden was of borderline significance in a multivariable model. Regardless of exact cause and effect, however, the current study debunks the widely quoted hypothesis that guns make a nation safer.

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For more than 200 years, ever since the second amendment stating “A well regulated militia being necessary to the security of a free State, the right of the people to keep and bear arms shall not be infringed” was passed in 1791, there has been a debate over guns in the US. On one end is the contention that there is no evidence suggesting that banning assault weapons would reduce crime, and gun control laws are an infringement on the right of self-defense and on constitutional rights. In addition, the notion that “guns make the nation safer” has become exceedingly popular.¹ Others have suggested that violence is often due to the perpetrator’s mental illness and

therefore, lack of treatment for mental illness may be more of a pressing problem than mere availability of guns.² This thought implies that mental illness and not merely the access to guns is the driving force for criminal activities. There is little question that the combination of mental illness and easy access to guns may prove to be synergistic in their lethality, as was seen in the shootings in Aurora, Tucson, at Virginia Tech, in Oak Creek, and other places in recent years. On the opposite end stands the contention that fewer firearms would reduce crime rates and overall lead to greater safety. Yet many of these arguments from both sides are based on little or no evidence. We sought to evaluate the relationship between prevalence of gun ownership and mental illness on firearm-related death in a given country.

METHODS

Definition and Data Sources

All data were restricted to the 27 developed countries listed, not currently in civil war and with data available on gun ownership, as outlined in the **Table**. Data on gun ownership per capita per country were obtained from the Small Arms Survey 2007.³ Data on firearm-related deaths per 100,000 population per country were obtained from a European detailed mortality database (World Health Organization)⁴ based on the following International Classification of Diseases-10th Revision codes: unintentional handgun discharge (W32); unintentional rifle, shotgun, and larger firearm discharge (W33); unintentional discharge from other and unspecified firearms (W34); intentional self-harm by handgun discharge (X72); intentional self-harm by rifle, shotgun, and larger firearm discharge (X73); intentional self-harm by other and unspecified firearm discharge (X74); assault by handgun discharge (X93); assault by rifle, shotgun, and larger firearm discharge (X94); assault by other and unspecified firearm discharge (X95); handgun discharge, undetermined intent (Y22); rifle, shotgun, and larger firearm discharge, undetermined intent (Y23); other and unspecified firearm discharge, undetermined intent (Y24); and from other sources.^{5,6} Crime rate was used as a putative indicator of safety of a nation and was obtained from the United Nations Surveys of Crime Trends.⁷ Crime rate was defined as the grand total of all recorded crimes as described in the survey. Age-standardized disability-adjusted life-year rates due to major depressive disorder per 100,000 inhabitants with data obtained from the World Health Organization database

was used as a putative indicator for mental illness burden in a country.⁸

Statistical Analysis

All variables were tested for normality, and non-normal distributed variables were log-transformed. Box plots were used to identify outliers. Pearson's correlation coefficient was used to assess the correlation between the above measures. In addition, a linear regression model was used to evaluate the predictors of firearm-related deaths with gun ownership and mental illness as the independent covariates. $P < .05$ was used to denote statistical significance.

RESULTS

Gun Ownership and Firearm-related Deaths

In having almost as many guns as it has people, prevalence of private gun ownership was the

highest in the US among both developed and developing countries. Japan, on the other end, had an extremely low gun ownership rate (**Table**). Similarly, South Africa (9.4 per 100,000) and the US (10.2 per 100,000) had extremely high firearm-related deaths, whereas the United Kingdom (0.25 per 100,000) had an extremely low rate of firearm-related deaths. There was a significant positive correlation between guns per capita per country and the rate of firearm-related deaths ($r = 0.80$; $P < .0001$) (**Figure, A**), with Japan being on one end of the spectrum and the US being on the other. In this correlation, South Africa was the only outlier in that the observed firearms-related death rate was several times higher than expected from gun ownership.

Do Guns Make a Nation Safer?

We then sought to evaluate whether possessing guns would make a nation safer, as has been a widespread contention. We used the crime rate per 100,000 population as an indicator of safety of the nation. There was no significant correlation ($r = 0.33$) between guns per capita per country and crime rate ($P = .10$), arguing against the notion of more guns translating into less crime (**Figure, B**).

Mental Illness and Firearm-related Deaths

We sought to assess whether the mental illness burden of a country correlated with the firearm-related deaths. Given the difficulty in a uniform quantification of mental illness, we used the age-standardized rates due to major depressive disorder per 100,000 inhabitants in a country

CLINICAL SIGNIFICANCE

- The association between gun ownership, mental illness, and firearm-related deaths has been hotly debated.
- Among the 27 developed countries, the gun ownership rate was a strong and independent predictor of firearm-related death, whereas the predictive power of mental illness burden was of borderline significance.
- Regardless of exact cause and effect, the current study debunks the widely quoted hypothesis that guns make a nation safer.

Table Gun Ownership, Mental Illness Burden, and Firearm-related Deaths and Crime Rate

Country	Guns per 100*	Total Firearm-related Deaths per 100,000†	Crime Rates per 100,000‡	Mental Illness per 100,000§
Australia	15.0	1.04	NA	846.94
Austria	30.4	2.94	7102.35	1108.30
Belgium	17.2	2.43	9271.89	1244.46
Canada	30.8	2.44	8311.34	1157.07
Denmark	12.0	1.45	6850.83	1110.76
Finland	45.3	3.64	9753.58	1344.13
France	31.2	3.00	6250.72	1234.32
Germany	30.3	1.10	7650.76	955.01
Greece	22.5	1.50	2171.44	632.05
Iceland	30.3	1.25	17,154.67	955.99
Ireland	8.6	1.03	2456.60	959.33
Israel	7.3	1.86	7174.07	1273.92
Italy	11.9	1.28	4697.44	776.38
Japan	0.6	0.06	1604.73	531.25
Luxembourg	15.3	1.81	5209.20	1110.00
Malta	11.9	2.16	4645.00	763.79
Netherlands	3.9	0.46	7429.55	861.59
New Zealand	22.6	2.66	10,344.73	851.07
Norway	31.3	1.78	5893.96	996.78
Portugal	8.5	1.77	3778.21	721.80
South Africa	12.7	9.41	5674.10	725.77
Spain	10.4	0.63	2312.40	620.77
Sweden	31.6	1.47	13,461.08	1060.42
Switzerland	45.7	3.84	3842.08	1114.11
Turkey	12.5	0.72	1339.84	1037.51
United States	88.8	10.2	3811.87	1454.74
United Kingdom	6.2	0.25	8972.35	960.62

*Average civilian firearms per 100 people; data from *The Small Arms Survey 2007: Guns and the City*.³

†Firearm-related deaths per 100,000 population; data from a European detailed mortality database based on International Classification of Diseases codes (ICD-10): W32-W34, X72-X74, X93-X95, Y22-Y24 and others.⁴

‡Crime rate data were obtained from the United Nations Surveys of Crime Trends and Operations of Criminal Justice Systems.⁷

§Mental illness defined as age-standardized <http://data.euro.who.int/dmdb/> rates due to major depressive disorder per 100,000 inhabitants with data obtained from the World Health Organization.⁸

as an indicator. There was a positive correlation ($r = 0.52$; $P = .005$) between mental illness burden in a country and firearm-related deaths (**Figure, C**).

Mental Illness and Crime Rate

Finally, we assessed whether there was a correlation between mental illness burden of a country and the crime rate in a country. There was a no significant correlation ($r = 0.32$) between mental illness and crime rate ($P = .11$) (**Figure, D**).

Multivariable Predictors

In a linear regression model with firearm-related deaths as the dependent variable, and gun ownership and mental illness as independent covariates, gun ownership was a significant predictor ($P \leq .0001$) and mental illness was of borderline significance ($P = .05$) for the prediction of firearm-related deaths. There was no evidence of multicollinearity in the model.

CONCLUSION

The present data suggest that the number of guns per capita per country correlated strongly and was an independent predictor of firearm-related deaths. Additionally, in a linear regression model there was a correlation with mental illness, but this was of borderline significance in a multivariable model. Although correlation is not synonymous with causation, it seems conceivable that abundant gun availability facilitates firearm-related deaths. Conversely, high crime rates may instigate widespread anxiety and fear, thereby motivating people to arm themselves and give rise to increased gun ownership, which, in turn, increases availability. The resulting vicious cycle could, bit-by-bit, lead to the polarized status that is now the case with the US. Regardless of exact cause and effect, however, the current study debunks the widely quoted hypothesis purporting to show that countries with the higher gun ownership are safer than those with low gun ownership.

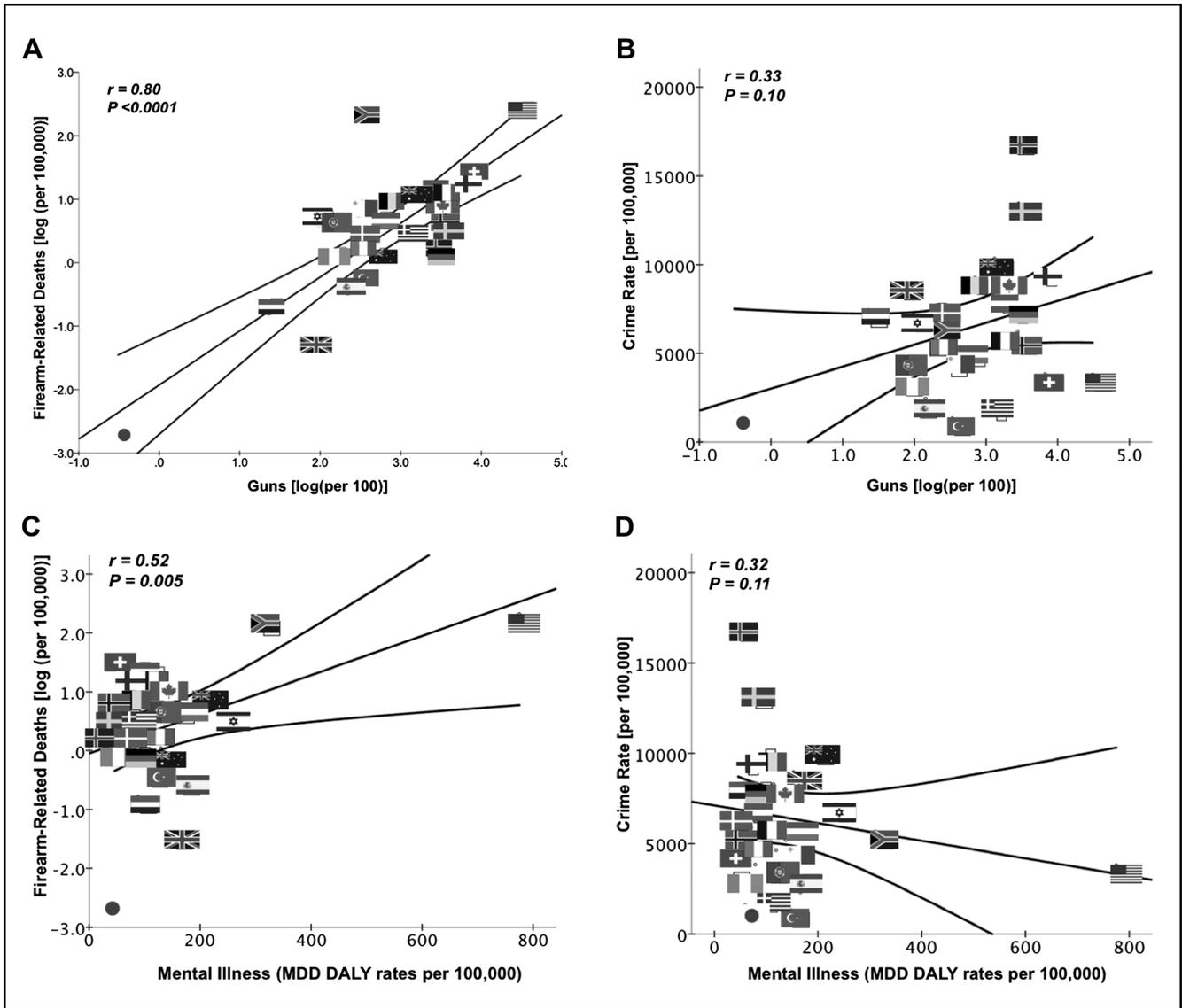


Figure (A) Guns per capita per country and firearm-related deaths. (B) Guns per capita per country and crime rates. (C) Mental illness per country and firearm-related deaths. (D) Mental illness per country and crime rates.

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