

First mathematical analysis of gun policy tradeoff emphasizes need for more data

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The first mathematical analysis of the gun policy tradeoff makes several assumptions due to a need for more scientific data.

(Phys.org) —While many people have already taken a stance on whether gun control laws need to be stricter or more lenient, a pair of researchers from the University of California Irvine argues that there isn't yet enough scientific data to make an informed policy decision either way.

Dominik Wodarz and Natalia Komarova, both from the Department of Ecology and Evolutionary Biology and the Department of Mathematics at the University of California Irvine, have developed the first [mathematical analysis](#) of the gun availability tradeoff. Their paper is published in *PLOS ONE*.

With 11,000 gun-related homicides occurring each year in the US, the gun policy tradeoff has been the subject of many recent arguments. While a strict "no guns" policy would seem to decrease the overall number of available guns and therefore decrease gun use, a "guns for all" policy that allows anyone to own a gun may arm potential victims and deter criminals from attacking in the first place. And then there is also a middle ground: a moderate gun policy in which certain kinds of guns are available to some people under certain circumstances.

So which policy is best? According to the model, the somewhat surprising result is that the gun-related homicide rate can only be minimized for the two extreme strategies: either a complete ban or a "guns for all" policy. The moderate policy—although seemingly most realistic of the three—results in a higher homicide rate than either of the two extreme policies. So the problem is still far from solved.

"The effect of partial restriction of [gun ownership](#) is complicated," Wodarz told *Phys.org*. "According to the model, a partial reduction in gun ownership can lead to a certain reduction in the gun-induced homicide rate, even if it does not minimize it. However, it is also possible that a partial reduction in gun ownership first leads to an increase in gun murders, and only leads to a reduction once gun ownership is restricted substantially. There is not enough data available at the moment to determine which outcome is more likely. Once more data are collected, we will be able to say something more concrete."

Overall, the big takeaway of the study is not a comparison of the

effectiveness of different gun policies, but that the data required to make such a comparison is lacking. The researchers' model makes several assumptions, such as the degree of law enforcement to prevent criminals from illegally owning guns, the degree of protection provided by guns to potential victims, and the fraction of the population that actually takes up its right to own and carry a gun, for which limited data exists.

For this reason, the researchers view their model as a first step on the path to scientifically and logically formulating the issues involved in the gun control debate, and to guide the design of future epidemiological studies. As they explain, "any mathematical model of a behavioral process represents by definition a simplification and abstraction of a complex system." From this perspective, the researchers propose that the gun control debate should focus on the scientific methods of gathering and interpreting data, rather than on single gun-related events that capture the public's attention or anecdotal evidence.

"What we tried to do is to examine how different strategies regarding gun availability in the general population influence the amount of shooting-induced murders that will occur," Wodarz said. "This is a scientific question, similar to asking how certain biomedical strategies influence the incidence of a disease (such as cancer) in the population.

"It was an interesting finding that the two extreme strategies minimize gun-induced murders. Regarding practicality: There are other issues that are relevant, such as constitutional issues in the US, which can limit the policies that can be implemented. However, our goal was to ask a very focused question about the amount of gun-induced murders, and to use scientific methods, based in the field of disease epidemiology. It is our hope that this will initiate a different kind of discussion, where people argue about scientific assumptions, data, and scientific methodologies. This would be the most immediate practical implication of our work,

and I think if this was achieved, it would be very valuable.

"Another, equally important practical implication of this work is that it identifies what needs to be measured statistically in order to make more precise predictions. Therefore, it serves as a guide for the design of future statistical studies, which will hopefully result in the availability of more data and thus more accurate predictions. As mentioned in the paper, right now only a limited amount of data is available in the literature and more data are needed to better parameterize and refine the model."

Here's some of the data that the researchers considered in their analysis:

- Currently, about 30% of all American households own a gun. Assuming that gun ownership offers some protection against attacks, this percentage does not provide sufficient protection against attacks to counter the increase in gun-related deaths that occurs under a "guns for all" policy, according to the model. If a "guns for all" policy were to be effective, the government would have to persuade more people to purchase guns and carry them around at all times.
- There is evidence that gun ownership by potential victims does not offer any protection from attacks. Previous studies have found that gun ownership by potential victims actually increases their chances of being fatally shot during an attack compared to potential victims who do not carry a gun. These studies suggest that gun possession might escalate a gun fight and make it less likely that the potential victim will retreat.
- The majority of gun-related homicides in the US are one-against-one attacks, although one-on-many attacks are usually more widely publicized. The researchers suggest that the results from one-against-one attacks should dictate policies in order to minimize the overall gun-related homicide rate.

- A study of a UK prison population that was not legally allowed to own guns revealed that 8% had illegally owned guns during the past year, of which 23% had taken the gun with them on an offense. That is, less than 2% of the individuals who were not legally allowed to own guns owned and used a gun for criminal purposes.

Finally, the researchers note that [gun policy](#) is not the only factor that contributes to the gun-related [homicide rate](#). This fact is highlighted by the gun policies of the UK and Switzerland. Both countries have drastically lower rates of gun-related homicide than the US, but very different gun policies. In the UK, private gun possession is largely banned, while gun prevalence in Switzerland is widespread. Clearly, other factors such as socioeconomic conditions and cultural differences also play an important role in reducing gun-related [homicides](#).

More information: Dominik Wodarz and Natalia L. Komarova. "Dependence of the Firearm-Related Homicide Rate on Gun Availability: A Mathematical Analysis." *PLOS ONE*. [DOI: 10.1371/journal.pone.0071606](#)

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