

Addressing America's Firearm Violence Crisis: An Epidemiological Approach to Environmental and Behavioral Interventions

Lisa Y. Kim

Firearm violence in the United States is a public health crisis and the leading cause of death for adolescents and young adults (Lee et al., 2022). Yet, it is often perceived as an issue rooted in an individual's mental state rather than a consequence of a lack of protective firearm policies. However, when addressing firearm violence, it is also crucial to identify the factors that contribute to violent environments and unintentional gun injuries. This paper examines the underlying factors that fuel firearm violence and proposes a comprehensive, evidence-informed firearm violence intervention from an epidemiological perspective: an orientation that focuses on the characteristics of the agent, host, and environment. Protective firearm policies directly address the agent: firearms. However, the environmental factors that perpetuate violence and the lack of education on safe gun storage should also be addressed. By addressing environmental risk factors such as alcohol misuse and a lack of green spaces in communities, the rates of firearm violence in low-income neighborhoods could be mitigated. Along with these efforts, interventions to teach gun owners about safe gun storage should be implemented to reduce the number of unintentional firearm injuries. Overall, addressing the firearm violence crisis will require a comprehensive epidemiological approach to account for its multifaceted nature. This framework focuses on the interactions between the disease-causing agent (firearms), host (gun owners and non-gun owners), and their shared environment (Centers for Disease Control and Prevention, 2023). In the context of firearm violence, applying the epidemiological model will target firearms (agents) and the individual behaviors and environments. Without this perspective, the social and environmental risk factors that contribute to firearm violence will continue to be overlooked.

Keywords

Gun Violence • Firearm Violence • Epidemiology • Firearm Policies • Safe Gun Storage
• Environmental Interventions

Vanderbilt University, Department of Medicine, Health, and Society, lisa.y.kim.1@vanderbilt.edu

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Introduction

In the early 2000s, motor vehicle crashes (MVCs) were the leading cause of death for children and young adults in the United States (Lee et al., 2022). Fortunately, due to public health-centered interventions, in the past 20 years, the country has observed nearly a 40% decrease in MVC-related deaths per 100,000 people in the same age group (Lewis, 2022). Public health experts recognized that solely implementing traffic safety laws would not fully address MVCs. Although these laws significantly reduced MVC-related deaths, they were successfully employed alongside complementary interventions. Dr. William Haddon, the director of the National Highway Safety Bureau (NHSB), employed interventions that addressed the epidemiological triad, focusing on the interactions between the agent (motor vehicles), environment (roads), and host (humans) that result in MVCs. This strategy targeted improvements to vehicle safety (e.g., safety belts, shatter-resistant windshields, and energy-absorbing steering wheels), road safety (e.g., breakaway signs, delineation of curves, and guardrails), and public education (e.g., safety campaigns that teach drivers to use seatbelts, drive sober, and maintain safe speeds) (Centers for Disease Control and Prevention, n.d.). The decline in MVC-related deaths highlights the success of employing public health solutions that target the epidemiological triad.

Although MVCs are no longer the leading cause of death for adolescents in the U.S., firearm-related deaths have now taken their place (McGough et al., 2023). In less than 10 years (2013–2021), the firearm mortality rate in children doubled (McGough et al., 2023). Furthermore, recent data notes that 4.3 million excess firearms were purchased during the COVID-19 pandemic (Schleimer et al., 2021). The excess in firearm purchases was measured as the difference between observed rates and predicted rates from a statistical model (Schleimer et al., 2021). This surge in firearm purchases was also temporally correlated with an increase in firearm injuries from domestic abuse and a nearly twofold increase in mass shootings in 2020 (Schleimer et al., 2021; “Mass Shootings,” n.d.). In response to the alarming growth in firearm violence, the U.S. Surgeon General, Dr. Vivek Murthy, released a public health advisory in June 2024, officially declaring firearm violence as a public health crisis (U.S. Department of Health and Human Services, 2024, 2:50).

Despite the overwhelming evidence that firearm violence is a worsening public health crisis, firearm violence is often perceived as an issue rooted within an individual. For example, a common public narrative attributes high rates of firearm violence to inadequately addressed mental illnesses (O'Brien, 2023). However, this perspective overlooks the environmental and host factors regarding knowledge of gun storage and safety that are also responsible for perpetuating firearm violence and injuries (Swanson et al., 2015). While it is true that almost 20% of the U.S. adult population experiences a mental illness, the National Center for Health Statistics notes that less than 5% of gun-related deaths from 2001 to 2010 were committed by people with a mental illness (National Institute of Mental Health, n.d.; Metzl & MacLeish, 2015). Moreover, a recent international study compared the U.S.'s firearm death rate to other higher middle income countries like Australia and the U.K. Despite sharing similar mental illness statistics, America observed a much greater firearm death rate: 10 times greater than Australia's and 40 times greater than the U.K. (Berglass et al., 2023). While addressing poor mental health is important, it alone does not explain the significant discrepancy in firearm violence rates between America and other countries, suggesting that firearm violence is a multifaceted issue (Iwundu et al., 2022). Consequently, studies have cited the need for policies regulating firearm access and use (Iwundu et al., 2022; Jehan et al., 2018). However, although adopting effective firearm policies is a necessary step to reduce firearm violence, it is an incomplete solution.

To address the full scope of firearm violence, it is important to employ interventions from an epidemiological perspective, specifically the key environmental and host factors. Similar to the strategies used to reduce MVCs, these interventions should target not only firearms (the agent) through protective firearm policies but also the environmental factors that foster violence within communities and the behaviors of individuals (host) by promoting safe firearm storage. This paper examines how addressing key environmental and host factors—elements often overlooked in firearm violence prevention—can complement firearm protection policies (the agent) to create a more comprehensive intervention that aligns with the epidemiological triad.

Addressing environmental risk factors: a lack of green spaces and alcohol misuse

From 2007 to 2016, 62% of firearm-related deaths among youth (aged 5–24) took place in counties where 15% or more of residents lived below the poverty line (Barrett et al., 2022). This highlights that individuals residing in lower-income neighborhoods are more likely to be exposed to violent crime and firearm violence (Scott Kegler et al., 2022). Two factors of the social and physical environment that can contribute to this violence include a lack of green spaces and alcohol misuse. Studies have found that addressing these factors can reduce violence and firearm-involved crime (Rosen et al., 2024; Shepley et al., 2019). Therefore, interventions targeting these environmental factors could include implementing more green spaces in neighborhoods and limiting the sale hours of alcohol sales (Branas, 2018; Rosen et al., 2024).

These examples of primordial prevention aimed at preventing the development of risk factors would effectively address underlying environmental conditions that increase the likelihood of firearm violence (Kisling & Das, 2024). Since firearm violence disproportionately impacts lower-income communities, environment-focused interventions should prioritize these vulnerable neighborhoods.

Vacant lands, abandoned buildings, and parking lots are more than just an eyesore to a neighborhood. They can also be perceived as a cover for illegal activities and crime, increasing residents' concerns regarding safety within their communities (Garvin et al., 2013). However, greening interventions could transform these spaces, promoting community safety and reducing the likelihood of illegal activity and violent crime. A recent study discovered that greening interventions within Philadelphia neighborhoods were associated with a decrease in firearm violence within neighborhoods below the poverty line (Branas, 2018). These interventions included greening vacant lots, seeding grass, planting small trees, and remediating abandoned buildings (Branas, 2018). As a result of these environmental improvements, study participants reported feeling less depressed and safer within their community, along with an increase in outdoor socialization (Branas, 2018). This study illustrates that improving neighborhood conditions through environmental interventions can be a promising strategy to help reduce the rates of firearm violence.

Although greening interventions have shown promising potential, it is important to recognize the confounding variables that may influence their effectiveness in promoting a safer environment and reducing violent crime (Shepley et al., 2019). The design and maintenance of green spaces are two factors that can impact their utilization, and consequently their ability to reduce violent crime. Thus, an ultimate challenge to greening interventions is ensuring that these spaces are consistently maintained over time.

Efforts to address environmental factors like green spaces are not the only approach to reducing firearm-related violence in vulnerable populations. Another risk factor commonly associated with violence and firearm-involved crime is alcohol misuse, a characteristic of the social environment. An estimated 1 in 3 gun homicide perpetrators drank heavily before murdering their victims, and 1 in 4 gun suicide victims drank heavily before their deaths (Sengupta & Hoyle, 2005). Thus, efforts to address alcohol misuse may help to reduce the number of firearm-related deaths and injuries. Specifically, limiting the hours of alcohol sale could prevent the chances of firearm-related violence associated with alcohol misuse. For example, a recent analysis of Baltimore's alcohol stores noted that reduced hours of alcohol sales were associated with a 23% decrease in annual violent crime and a 51% decrease in homicide rates (Rosen et al., 2024). This study highlights the potential impact of limiting alcohol sale hours on mitigating firearm violence.

However, it is also important to note the limitations of reducing alcohol sale hours. A potential unintentional consequence could be a shift to illegal or unregulated sources of alcohol. Furthermore, restricting alcohol sales may only reduce some cases of alcohol involved firearm injuries but it is unlikely to be a comprehensive solution on its own. This solution should be viewed as part of a multifaceted approach to address firearm violence. Thus, in addition to addressing environmental risk factors such as alcohol availability, it is also important to consider individual behaviors that contribute to unintentional firearm injuries, such as safe gun storage practices.

Addressing host-related risk factors: Implementing safe gun storage practices

As of 2015, one-third of all U.S. households with children owned firearms, and 4.6 million of these children had access to at least one loaded and unlocked firearm (Miller & Azrael, 2021). Thus, every year 350 children under the age of 18 unintentionally shoot themselves or someone else in the country (Preventable tragedies, n.d.). Previous studies have also found that gun owners who misuse alcohol are more likely to engage in risky gun behavior such as unsafely storing their guns (Nordstrom, 2001). A 2019 study found that firearms are 20% more likely to be stored unsafely if an adult reports chronic alcohol use (Morgan et al., 2019). This is concerning because unsafely stored guns can result in unintentional firearm violence injuries, especially among children (Miller & Azrael, 2021). These statistics illustrate the need for educational interventions that not only promote safe gun storage practices but also teach children about firearm safety. This strategy would aim to encourage responsible firearm storage among gun owners and educate families about the risks of unsupervised firearms around children, effectively targeting the host in the epidemiological triad.

To increase safe gun storage, firearm shops can promote safe storage options and trigger locks when selling firearms. In addition, local health providers can inform families with children about the risks of unsafe gun storage and unsupervised interactions with firearms. These interventions would involve one-on-one interactions with gun owners and non-gun owners. On the other hand, community-level interventions to promote safe gun storage would take place at large gatherings such as gun conventions or community safety fairs. A 2015 study utilized surveys to determine if attending a community firearm safety event changed participants' firearm storage practices. After attending the event, a significantly greater proportion of participants reported practicing safe firearm storage (Simonetti et al., 2017).

Combining these individual and community-centered educational interventions could help reduce children's exposure to unsafely stored firearms, resulting in fewer unintentional firearm injuries. Although policy changes to enforce stricter gun storage are an ideal long-term solution (RAND, 2024), implementing educational awareness about safe gun storage may more immediately reach individuals and communities most affected by both intentional and unintentional firearm injuries. By promoting these educational interventions, the host-gun owners and non-gun owners—will be encouraged to practice safe gun storage and educate their children about the risks of handling firearms unsupervised.

Conclusion

The decline of MVC-related deaths in the early 21st century demonstrated that comprehensive public health-centered interventions can mitigate public health crises. Adopting a similar intervention from an epidemiological perspective to combat firearm violence would require policy changes beyond solely enforcing protective firearm policies. This would entail effectively addressing the environmental and host factors that are associated with firearm violence and unintentional injuries.

To improve community safety, reduced alcohol sale hours and improved green spaces are two environment-focused interventions that could help reduce rates of firearm crime, specifically in lower-income neighborhoods disproportionately impacted by such violence. These environment-centered interventions target the prevention of firearm violence in high-risk communities. There are also educational interventions that can address the behavior of the hosts (gun owners and non-gun owners) to prevent unintentional firearm injuries across all demographics. Educational campaigns that raise awareness about the consequences of unsafe gun storage and unsupervised firearms could encourage safer gun storage practices.

“All of us, regardless of our background or beliefs, want to live in a world that is safe for us and our children” (U.S. Department of Health and Human Services, 2024, 2:40). While opinions on firearm policies have become a polarized topic in the U.S., the need for a multi-faceted public health intervention to address firearm violence should not be. However, a common limitation of addressing firearm violence from a public health perspective is its failure to acknowledge the values of gun culture in American society. Unlike policies that address automobile safety, firearm policies face a unique challenge because they hold a cultural significance to many Americans. For instance, firearms can symbolize family traditions (i.e.: hunting), self-protection, and a fundamental right protected by the Second Amendment (Boine et al, 2020). As a result, firearm policies can be perceived more as an infringement of personal freedoms and less as a public health intervention. Thus, public health officials should address firearm violence from an epidemiological perspective. Doing so may help bridge the gap between public health interventions and the values of firearm owners, fostering greater public support for effective firearm policies.

Employing a public health approach would address all three components of the epidemiological triad: agent, environment, and host. Advocating for protective firearm policies directly addresses the agent, but these efforts should also be coupled with policies to address the environmental factors that perpetuate firearm violence. Furthermore, educating both gun owners and non-gun owners on the risks of unsafe gun storage could help reduce the number of unintentional firearm injuries. The combination of these interventions will not only help mitigate violence in high-risk communities but also equip individuals with the knowledge to prevent unintentional firearm injuries.

However, since firearm policies have become a politicized topic in the United States, it requires ensuring these interventions are maintained with adequate funding, evaluation measures, and community support. Ensuring that policies have a funding source will ensure they become actionable in an appropriate time frame. Therefore, environmental greening interventions should be tied with adequate funding to support immediate and sustained implementation. In addition, once these policies are in place, evaluation methods—such as hospitals tracking firearm related injuries and deaths or state-level surveillance systems—will provide evidence that these interventions are effective. This evaluation is crucial to persuade policymakers and the public that firearm interventions are effective. Finally, garnering community support from the public—especially gun owners—will help prevent public backlash and build trust. Including community members in policy design will help ensure they are publicly supported and meet the needs of those most affected by firearm violence.

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