

Before the Bullets Fly: The Physician's Role in Preventing Firearm Injury

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Firearm injury is a disease that is disproportionately prevalent in the United States. When a bullet hits a human being, it brings together multiple structural determinants of health into one acute, life-changing event. Firearm injury can lead to long-term mental and physical challenges for individuals, families, and communities. Despite the impact of this disease, physicians often underestimate their role in not only treating but also preventing firearm injury. Physicians can intervene through screening, counseling, community engagement, and advocacy, and can mobilize the health care systems they serve to engage with injury prevention. Physicians also play a key role in expanding the knowledge base on firearm injury through much-needed research on the epidemiology, context, and outcomes of firearm injury. When we treat firearm injury as a disease, we can develop and implement interventions from the clinic to the statehouse that can curb profound harms. This work and these opportunities belong not only to emergency physicians and trauma surgeons, but to all fields that evaluate and assess patients over the life course.

INTRODUCTION

Airway, breathing, and circulation. Lactated ringer's, massive transfusion protocol, tranexamic acid, calcium gluconate, sodium bicarbonate, and cefazolin. Mechanical ventilation, continuous renal replacement therapy, total parenteral nutrition, enoxaparin, pantoprazole, and senokot. Metoprolol tartrate, furosemide, and enoxaparin. This is a small sample of the therapies patients may receive after being severely injured by bullets. Firearm injury is a medical problem, and it is not getting better. After two decades of improvement, firearm injuries and deaths from suicide and interpersonal violence have increased in the last several years.

In trauma surgery, we control hemorrhage at the

source with clamps, sutures, ties, staples, and shunts, but getting a patient through the acute illness caused by bullets takes much more than this. These injuries also lead to ailments both physical and psychological that can last for months, years, or a lifetime. Over the last decade, the US has seen an average of 34,516 deaths from firearm injury, and an additional 85,694 emergency department visits and hospitalizations for non-fatal firearm injury. Suicides account for the majority of firearm injury deaths (61.2%), and suicide attempt by firearm carries a nearly 90% case fatality rate. Firearm assaults are the most common intentionality overall, and nearly three in four injured individuals survive. Unintentional firearm injury leads to death in only 1.2% of cases, but between 20 and

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50% [1,2] of nonfatal firearm injuries are classified unintentional (depending on the data source used), highlighting the difference in severity of injury. Legal intervention injuries, defined as injuries caused by a law enforcement officer in the course of their duties, are a relatively rare, but crucially important form of firearm injury. There are nearly 1,000 deaths from legal intervention firearm injury each year in the US [3], with approximately three times as many non-fatal injuries.

Firearm injury affects us all, but it does not do so equally. More than 80% of firearm injured patients are men. Firearm suicides have increased in the last decade and are most common among people ages 55 and older; in rural areas, among men, and among White people and Native Americans [4]. Black adolescents and young men are at 10-fold increased risk of firearm homicide compared to their White peers. Unintentional injuries, meanwhile, predominate among young children and in rural areas. Likewise, the risk of death after firearm injury of any intent is higher in rural areas, which may relate to weapon type, shooter skill, context of injury, and access to timely trauma care [5,6]. This variation is not random. Structural racism, poverty, and concentrated disadvantage fed by historical and contemporary public policy fuel the violence that impacts communities of color so disproportionately [7].

Firearm injury is a medical problem, but it is more than that. Firearm injury often represents the sharpest, hottest end of broad social and structural forces that mix an individual with a moving bullet, transforming often, a previously healthy person into a critically ill patient in an instant. Programs and policies to prevent firearm injury may originate in and include numerous disciplines including public policy, social services, engineering and more; the impact of firearm injury extends beyond health. Physicians can incorporate an understanding of the complex contributors to firearm injury to strengthen our efforts to prevent injury and death.

While oncologists investigate early detection and prevention of cancers, and cardiologists study risk reduction to prevent myocardial infarction, prevention of firearm violence has too often been seen as outside the scope of physicians and our healthcare system. With a robust understanding of the health consequences of firearm injury, however, we have no choice but to work to prevent this disease, and to enlist our colleagues across the disciplines of health care to help us in this crucial mission.

THE ROLE OF CLINICIANS IN PREVENTING FIREARM INJURY

Educating Health Professionals

Undergraduate and graduate medical education

has been largely silent on firearm injury, with just 1 in 4 current physicians receiving training on firearm injury prevention [8]. Physicians can be effective agents for promoting firearm safety through patient counseling, but without training on effective counseling methods, physicians lack the confidence to discuss what many see as a sensitive topic with their patients, and do so less often than they could [9,10]. Medical schools, including the Miller School of Medicine (University of Miami, Miami, FL) and Washington University in St. Louis (St. Louis, MO), have started courses focused on firearm injury [11], but this content should be implemented universally.

Firearm injury prevention also belongs in graduate medical education, as well, not only for surgeons and emergency medicine physicians who care for patients injured by firearms, but also for pediatricians who work with families to reduce many other forms of health risks, for psychiatrists who care for patients at risk of suicide, for internists and geriatricians who may encounter aging patients with declining cognitive status who keep firearms at home. For existing physicians, continuing medical education offers an opportunity to update knowledge on firearm injury prevention, but to date this has rarely been used [8].

Counseling Patients

As clinicians, one of our most powerful interventions is the ability to communicate our own expertise. Just as physician counseling can effectively promote smoking cessation [12], emerging evidence indicates that counseling can promote firearm safety. The majority of physicians support counseling patients on gun safety [13], but data from surveys [14], and chart reviews [15] indicate that counseling is rare [16]. This disconnect may be related to competing priorities in a busy clinical setting [17], but can also stem from physicians' lack of practical education [18] or to physician expectations that patients will object to discussing firearms. These discussions may have been deterred by a Florida law that banned physicians from asking patients about firearms. This law was overturned in 2017, in part through physician-led advocacy, and no other state has passed a similar law [19]. Moreover, in a national survey, two thirds of respondents believed that it is appropriate for physicians to talk about firearm safety, including more than half of gun owners. Patients were particularly open to discussing firearms when children were in the home or when suicide was a risk [20]. Table 1 lists resources for screening and counseling to promote firearm safety.

Child Injury Prevention

Storing a firearm unloaded, locked, and separately from ammunition can reduce injury risk for children and

Table 1. Examples of Firearm Injury Prevention Resources for Clinicians.

Topic	Source	Website
Pediatric Safety Screening	Bright Futures pediatric intake form	https://www.brightfutures.org/mentalhealth/pdf/professionals/ped_intake_form.pdf
Pediatric Safety Screening	FiGHTS screening tool for adolescent firearm carrying	https://www.aafp.org/afp/2004/0815/p770a.html
Pediatric Safety Screening	SaFETY score	https://www.acpjournals.org/doi/10.7326/M16-1927#.X4clm8lbu-l
Pediatric Safety Screening	Firearm Injury Prevention Video Series	https://open.umich.edu/find/open-educational-resources/medical/firearm-injury-prevention
Patient Counseling	StandSAFE	https://www.standsafe.org/education
Patient Counseling	What You Can Do	https://health.ucdavis.edu/what-you-can-do/
Patient Counseling	Bullet Points Project	https://www.bulletpointsproject.org/
Clinician Education	Firearm Violence: Policy, Prevention & Public Health Continuing Medical Education course	http://www.massmed.org/Continuing-Education-and-Events/Online-CME/Courses/Firearm-Violence-Module-1/Firearm-Violence--Policy,-Prevention---Public-Health/
Clinician Education	Harvard Injury Control Research Center	https://www.hsph.harvard.edu/hicrc/firearms-research/
Firearm Safety	American College of Surgeons	https://www.facs.org/quality-programs/trauma/advocacy/ipc
Safe Storage	American Academy of Family Physicians	https://familydoctor.org/gun-safety/
Safe Storage	Project ChildSafe	https://projectchildsafesafe.org/

adolescents. One in three US homes contain at least one firearm, and only 30% of firearm owners store all their firearms in the most secure way, leaving approximately 5 million children in homes with firearms that are loaded and unlocked [21]. Physician counseling, particularly when combined with gun lock distribution, can increase safe storage from 21 to 300 percent [22-24]. The protection offered by secure firearm storage may extend to adults in the home and to the broader community. Securely storing firearms can prevent theft, a major source of firearms subsequently used in interpersonal violence [25].

Suicide Prevention

Suicides make up 60% of firearm deaths, and more than half of completed suicides involve a firearm [4]. People who survive a suicide attempt have the chance to receive mental health and other support that can prevent another attempt, and just 10% go on to die by suicide [26]. People living in homes with firearms are no more likely to screen positive for suicidal ideation or to attempt suicide, but their risk of death by suicide is up to three times higher [27]. Firearms are a highly lethal means of suicide; only 10% of people who attempt suicide with a firearm survive [28]. Because suicidal episodes are often short lived, strategies of lethal means reduction—separat-

ing that individual from firearms in time and space—can be lifesaving [29,30].

Interpersonal Violence

Screening can also identify patients at risk of violent victimization, and counseling can reduce their risk. In the SaFER Teens program, adolescents presenting to the Emergency Department for any reason are electronically screened, regardless of the reason for their visit. Those identified as having key risk factors for violent injury, such as a recent history of fighting, alcohol use, or having a gun pulled on them receive a single immediate intervention from a trained counselor. This program has been shown to reduce both violent victimization and peer aggression at one year [31]. Violent injury is a recurrent disease, with rates of recurrence ranging from 11 to 55% depending on the population and time frame studied [32]. Hospital-based violence intervention programs that enroll injured patients into comprehensive services can prevent recurrent injury in this key group [33].

Health System Interventions to Prevent Firearm Injury

Firearm injury requires acute, unscheduled care and thus embodies a health system's relationship with its surrounding community. Patients cannot comparison shop

for their injury care. Firearm injury costs \$622 million for inpatient hospital admissions alone in the US each year. Because firearm violence disproportionately affects populations at substantial social disadvantage, uninsurance is common, and 25% of this care goes unreimbursed [34].

As firearm injury has increasingly been recognized as a public health challenge, health systems have gradually taken on responsibility to fund research, programing, and infrastructure [35,36]. Health systems can assess the impact of firearm injury on their surrounding communities. Although the Affordable Care Act requires non-profit health systems to perform a community needs assessment every 3 years, a minority of these needs assessments address community violence [30]. Health systems can institutionalize and support the individual-level interventions described above, and can employ and invest in prevention professionals, who come from affected communities and who serve as credible messengers for patients at risk of violence and injury. The cost of treating firearm injury is high, and effective violence prevention can be cost-effective for a health system. For a cost of \$50, the SaFER Teens program can prevent an ED visit that would cost more than \$1,000 [37]. Likewise, hospital-based violence intervention programs have been shown to reduce costs [38].

Health systems can also expand their reach into the communities they serve by supporting violence prevention in schools and communities. Health systems are often also major employers and spenders in their local economies. By using their own budgets to support community development, growth, and equity, health systems can reduce the economic and social conditions that contribute to violence [39]. Health systems can also use their status and influence to advocate for policy change that can prevent violence.

Community Engagement and Advocacy

Physicians are effective advocates for policies and programs that support our patients, such as seatbelt use [40] and smoking restrictions [41]. We carry with us powerful narratives brought from the bedside, along with the professional authority of our role. While our patients' busy lives and scarce opportunities may limit their ability to advocate for systematic change, physicians have the obligation to represent our field and our patients in the wider community and policy spheres. We can stand up against the state-sponsored killing of people of color, and demand funding for public health rather than policing and punishment. We can and should collaborate with community groups to increase the funding and programming needed to understand and prevent firearm injury.

Social policy can have a profound impact on firearm injury particularly as it perpetuates or works to reverse structural racism and poverty. Equity in education fund-

ing and housing address the root causes of interpersonal violence [42]. Communities with stronger public school systems that include robust extracurriculars have been shown to have lower rates of firearm injury [43], whereas communities that are underfunded and disenfranchised have higher rates [44]. Public policies that decrease economic inequity through progressive taxation, minimum wage increases, and meaningful unemployment benefits can further combat this crisis. These policies can play a role in reducing risk of suicide, as well. Suicide is most prevalent in older, White men and Native Americans, and the rise in suicide in recent years has been conceptualized as "deaths of despair" stemming from reduced opportunities and economic prospects [45].

Firearm Injury Research

Firearm injury research lags behind the prevalence and severity of this disease, receiving only 1.6% of the funding that would be predicted based on the number of deaths it causes [46], and rates of publication were decreasing up until the early 2000s [47]. While the 1996 Dickey amendment did not prohibit firearm injury research, it did bar the CDC from firearm-related advocacy, and had a chilling effect on funding for firearm research and on the interest of researchers hoping to build careers. Nonetheless, injury research centers [48] and dedicated scholars have continued to advance the field, developing new evidence, and prioritizing key areas for study [49-51]. Private funders have also attempted to meet this need, including the Joyce Foundation, and more recently, the American Foundation for Firearm Injury Reduction in Medicine (AFFIRM), and the National Collaborative on Gun Violence Research [52-54]. For the first time in decades, new funding streams have emerged to address this challenge, and the CDC funded its first new round of grants in Fall 2020 [55]. This change comes none too soon, as even foundational knowledge is lacking. Data are scarce regarding key topics such as nonfatal firearm injuries, circumstances surrounding injury, and the types and trajectories of firearms used [1]. Even more urgently, we know too little about what policies and programs can effectively reduce risk of injury and enhance recovery. There is much work to be done.

CONCLUSIONS AND OUTLOOK

Firearm injury can transform the lives of entire communities or end the life of one individual in a single moment. The consequences of firearm injury often reach beyond the initial injuries sustained by the bullet itself; the discharge of the gun causes profound physical and mental health challenges that often extend far beyond the lifetime of the inciting event. The consequences of firearm injury also reach beyond the injured individual

to affect families, communities, health systems, and ultimately, US society as a whole. In caring for individuals injured by bullets, medical professionals must confront not only the pathophysiology of hemorrhagic shock or sepsis, but also the systemic forces and structural inequities that bring our patients through the emergency department doors. If we focus only on the former, we will never be able to cure this illness that has been ravaging our home for far too long.

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