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OBSERVATIONS



Gun Violence Education in Medical School: A Call to Action

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ABSTRACT

Issue: Gun violence is a major public health burden, adversely affecting patients, families, and communities across the United States (U.S.) and the world. To manage the burden of injury from gun violence and identify primary, secondary, and tertiary prevention strategies, physician leaders must understand the biological and psychosocial aspects of this complex problem. However, gun violence and its complexities are not widely taught in medical schools. This Observation article details why gun violence education is not being included in medical education, offers an informed, science-based model for the disease of gun violence, and suggests methods to integrate gun violence education into medical school curricula. *Evidence:* We surveyed the literature for articles addressing this topic and for studies on medical school education and curriculum changes. We also examined some of the resources commonly used in medical school for mention of gun violence. Finally, we conducted a query of the AAMC Curriculum Inventory to further see if gun violence is currently incorporated into participating U.S. medical schools' curricula and found that gun violence is not a topic discussed in any significant capacity at most U.S. medical schools. Only 13–18% of schools that participated in the AAMC Curriculum Inventory during the years 2015–2018 documented gun and firearm content in their curriculum. Any other disease with similar number of deaths and injuries would be considered worthy of inclusion into medical education curricula. *Implications:* Medical school curricula commonly adjust with the ebb and flow of disease. Although gun violence meets the classic definition of a disease and is a major cause of harm and death, it is not taught to medical students. We assert that gun violence should be taught and framed as a biopsychosocial disease, highlighting many opportunities for interventions across a team of health care providers and physician leaders. We strongly urge medical schools to evaluate their curricula, address this teaching gap, and train the next generation of physician leaders to address all aspects of gun violence.

KEYWORDS

Gun violence; firearms; education; biopsychosocial model; injury

“...the professions of medicine, nursing, and the health-related social services must come forward and recognize violence as their issue and one that profoundly affects the public health.”

- C. Everett Koop, MD, Former Surgeon General, Public Health Service 1991

Gun violence was the cause of an estimated 251,000 deaths globally in 2016 with 50.5% of these deaths occurring in only six countries: The U.S., Brazil, Mexico, Columbia, Venezuela, and Guatemala.¹ Understanding the complex biologic and psychosocial aspects of gun violence is extremely important to managing the enormous worldwide burden of these injuries in emergency rooms, hospitals, and communities and in identifying primary and secondary prevention strategies. Since the U.S. contributes significantly to firearm morbidity and mortality (39,740 deaths and over 100,000 non-fatal injuries in 2018),² we wanted to examine how U.S. medical schools address this issue.

Gun violence is not a topic given much time, attention, material, or lecture hours in U.S. medical schools. Yet rarer diseases with far less mortality and morbidity are part of

the curriculum of all U.S. medical schools. For comparison, Tangier Disease (approximately 100 cases identified total worldwide),³ and tuberculosis (with 9,093 reported cases in the U.S. in 2017)⁴ are both thoroughly taught. Although it is important for future physicians to be aware of these diseases with low incidence and prevalence, the same attention is not given to gun violence, despite its higher case rate.

Puttagunta et al., reviewed current articles about gun violence education programs and their efficacy.⁵ Only four articles were found on the efficacy of gun violence education for care providers, and of those only two included undergraduate medical students. One intervention included a three-hour violence prevention workshop that was an overview of many types of violence, including firearm violence. The other intervention involved a one-hour presentation of a case followed by discussion which included how physicians can communicate or intervene with patients at risk of gun violence.⁴ Both studies' only results were post-session evaluations completed by the students, demonstrating a need to develop and evaluate education on gun violence in undergraduate medical curricula.

Reviewing textbooks and resources used in an example school's second year curriculum showed no mention of the psychosocial aspects of gun violence, and only very limited mention of the biology of gunshot wounds.⁶

A query of the AAMC Curriculum Inventory further indicates the lack of curriculum content related to gun violence. According to Inventory data uploaded by curricular deans at 127 to 134 of the 150 accredited U.S. medical schools between 2015–2018, 21 schools documented educational content involving guns and firearms in the 2015–2016 academic year, 24 in 2016–2017, and 18 in the 2017–2018 academic year. Maximum reported teaching events involving guns and firearms increased from two in 2015–2016 to three in 2016–2017 and then to ten in 2017–2018, however the median remained at one for all three academic years. The method of teaching was mainly lecture for all years (12–14 reported) with few additional instances of large and small group discussions, film/video, patient presentations, problem-based learning, and simulation (one to three instances of each). In terms of assessment methods, there were four to five reported institutionally written exams each year that involved some sort of questioning on guns and firearms.⁷ It should be noted that this data is self-reported and thus content may be missing if not directly input to a school's curriculum management system. However, it is clear that there is currently little coverage of the topic of gun violence in medical schools.

With almost 40,000 deaths and approximately 100,000 injuries each year, any other disease would be considered worthy of inclusion in U.S. medical school curricula. We assert that gun violence should be framed and taught as a biopsychosocial disease, highlighting many opportunities for interventions across a team of health care providers and physician leaders. These opportunities to improve patient outcomes and prevent future injury need to be discussed with medical students, just like other diseases presented in the curriculum. This Observations article is intended to advocate for medical schools in the U.S. and across the world to develop and adopt curricula on how to prevent and manage gun violence, just as they teach how to prevent and treat other diseases.

Why gun violence is not discussed in medical school

Physicians have largely been thought not to have anything to do with gun violence except to treat the aftermath of gunshot injuries. It is generally considered to be a social and/or criminal justice issue, without opportunities for physician intervention until after injuries have occurred and surgical and rehabilitation care is needed. This belief was evidenced by the recent “Stay in your lane” comments in the media discouraging physicians from participating in gun violence research and prevention.^{8,9} Furthermore, many individuals see gun violence as a self-inflicted societal problem thus, perhaps consciously or unconsciously, blaming the victims.

However, one survey found that 80% of physicians believe that gun violence is a major public health issue and should

be included in medical training.¹⁰ In another study, 65–93% of surgeons, family physicians, internists, psychiatrists, and pediatricians believe gun safety counseling is within a physician's scope of practice.¹¹ Many physicians believe firearm safety counseling is effective at reducing rates of firearm-related suicides and homicides.¹¹ Despite the majority of physicians believing in the importance of this issue, chart reviews have shown that gun access or firearm counseling is documented 3% or less of the time in internal medicine and pediatric emergency departments.¹¹ There appears to be a disconnect between the prevalence and perceived importance of gun violence compared to what is taught in medical schools and what is practiced by physicians.

From a curriculum dean standpoint, there are significant challenges encountered when considering adding new topics to an already full curricular schedule, especially those that require a multidisciplinary or integrated approach to teaching. Most course directors feel that they are already teaching the necessary relevant content of their course and are reticent to remove material to allow for new topics to be covered. Additionally, gun violence does not easily fit into discipline- or disease-based models for preclinical instruction.¹² The reluctance to change is exacerbated by lack of experience, expertise, and clear guidance about gun violence from national organizations, such as the CDC or other physician groups. This lack of training guidelines has been noted as a significant barrier to gun violence counseling education in other studies as well.¹¹ Furthermore, there has been a historic lack of physician champions in the area of gun violence education. Without a critical mass of invested faculty, most medical schools have not felt the urge or pressure to address the topic.

Curricular change is possible, however, when enough pressure is applied. In the latter half of the 1980s, medical schools were devoid of curricular content devoted to HIV/AIDS prevention and treatment, despite it already becoming a pandemic. In 1999 the World Health Organization urged medical schools to include it in the curriculum.¹³ Every medical school now has curriculum devoted to this challenging biopsychosocial disease. As other diseases are identified and researched, medical schools have addressed them in a manner appropriate to the burden inflicted on the communities that their physicians serve. Gun violence, a complex biopsychosocial disease¹⁴ with a high morbidity, mortality, and societal burden, is another epidemic that has been affecting communities across the U.S. for decades and should be integrated into medical school curricula.¹⁰

Unlike a lot of diseases, the immediate pathophysiology of gun violence occurs outside the direct observation of physicians. In less than a millisecond, the bullet tears tissue, stretches or destroys organs, fractures bones, and causes life-threatening hemorrhage.¹⁵ Many other conditions unfold in front of the physician at the bedside, clinical progress can be monitored, and interventions can be made during the pathophysiology of the disease process. This is not the case with the biological damage of gun violence. Patients arrive in emergency departments with the biological element of the disease process already complete. The tissue and organ damage is then “fixed” by teams of nurses, physicians,

and surgeons implementing time-sensitive interventions to stop bleeding and repair bones and vital organs.

Medical schools are dominated by a biomedical approach to disease. Although this is sufficient for some diseases, many other conditions (i.e. chronic pain, addiction, mental illness) are more complicated, and this narrow view of disease processes ignores many challenges to psychosocial elements, public health, and patient outcomes. Gun violence is a complex biopsychosocial disease and most medical schools have not completely integrated the biopsychosocial model into their curricula.¹⁶

The biology of gun violence is addressed in a limited fashion. For example, the 10th edition of Robbins Basic Pathology, a textbook used in many medical schools' courses, mentions gunshot wounds once in terms of postmortem damage. However, the overall burden of injury to individual patients as well as communities and any accompanying complications are not comprehensively addressed.

Gun violence also involves sciences that are fragmented in the medical school curriculum; public health and population health sciences are rarely integrated into the biomedical sciences. An integration of sciences is necessary if students are to understand the whole picture of the gun violence disease burden. Recently the National Academies of Sciences published a recommendation for schools for health professions (including schools of medicine and nursing) to “incorporate competency-based curricula on social care” including social determinants of health, approaches to advancing health equity, and social risk screening.¹⁷

Another possible reason for the absence of gun violence curriculum is its high case fatality ratio. Sixty percent of firearm deaths are suicides¹⁸ and it has the highest case fatality rate of any suicide method (85–90%), compared to 2% or less for overdoses and self-injury with a sharp object.¹⁹ While the ratio is not as high, firearm related assaults also have a significant case-fatality rate of 19–22%.^{20,21} Many patients simply do not survive long enough to get to a hospital. Not only does this aspect of firearm injuries make them difficult to treat, it also makes them challenging to research. This obstacle, along with a lack of federal funding, has resulted in a shortage of evidence-based research to support curriculum development and integration into medical schools. Since the 1990s there has been limited research support for gun violence, both from the CDC and the NIH. Currently there are limited research pathways for medical students and faculty to study gun violence and the topic is given little attention from the NIH compared to other equally sizeable problems. Further, NIH research funding drives medical school rankings. There is little incentive for faculty to develop curriculum for a disease process that receives no funding and has no “home” in the NIH.^{22,23}

Briefly, in 2013, there was an investigator-initiated call for proposals for violence prevention, with gun violence briefly mentioned.²⁴ More recently, medical organizations such as AFFIRM and the American College of Physicians have been calling for research funding for gun violence.^{25,26} Most recently, there has been a very modest funding of gun

violence research awarded to the NIH and CDC (total of \$25 million): an amount that is woefully inadequate, but a beginning. We hope these calls for action continue, and federal funding increases further, (such as \$100 million per year), so that the barriers to gun violence education in medical schools may begin to effectively be eliminated.

Why medical schools should teach students about gun violence

As was seen with HIV/AIDs, and now with COVID 19, medical school curriculum adjusts with the ebb and flow of diseases effecting the communities their graduates will serve. It is now necessary for medical schools to adjust and address the disease of gun violence in order to create future physicians who are competent in treating patients in this disease of modern society. Firearm deaths across the world are increasing. Specifically, in the U.S. in 2017 there was a 1,115 death increase (2.9% increase) from the previous year²⁷ and this increase was maintained to show similar numbers in 2018.²

The biopsychosocial (BPS) disease model, since its inception in 1977,²⁸ is increasingly taught in medical schools. There is building evidence of its positive impact on patient care and outcomes. Considering and treating the whole patient, along with preventative medicine, has become more universally accepted and seen as necessary for providing quality care.^{29,30} Although not fully integrated, new curricula have been shifting in recent years toward using BPS models for diseases taught in the basic science years.³¹ A course on gun violence aligns appropriately with these evolving curriculum changes and can be modeled similarly to other problems such as the opioid epidemic, obesity, and domestic violence.

Gun violence meets the classic definition of a disease; it has an agent (the bullet and its kinetic energy), a brief but immediate pathophysiology (the tearing and crushing of tissues) followed by morphologic changes (edema of tissues, disruption of organ function), and clinical manifestations (shock, fractures, hemorrhage).^{5,13} Gun violence also has unique characteristics, risk factors, treatments, and outcomes. With the high number of deaths and non-fatal injuries, far more patients, families, and communities are affected by gun violence than other diseases discussed in the curriculum. The opioid epidemic, another recent disease plaguing the nation, is already being integrated into medical schools.³² With a comparable number of deaths, it is logical that gun violence also be discussed.

Based on beneficence, it is a physician's duty to act to ensure the safety of their patients and this includes risk factors of violence. Although domestic, elder, and child violence is often addressed, firearm violence is conspicuously missing. Physician counseling and patient education is used to prevent injury and correct medical misinformation regarding behaviors such as smoking, drinking excessively, seatbelt and bike helmet use, and domestic violence. This tool can and should be applied to firearm safety and gun violence prevention and control.

Team based care is increasingly seen as a vital skill for the graduate physician. Virtually every specialty takes care of patients injured by gunshot wounds and those at risk. From emergency medicine, trauma surgery, anesthesiology, and radiology to physical medicine and rehabilitation, psychiatry, and family medicine, there is not a specialty that is exempt from having to treat these patients. No matter in which direction students go with their medical careers, they will encounter patients who have been injured by bullets.

How to incorporate gun violence into the curriculum of U.S. medical schools

Many schools have found ways to imbed other complicated biopsychosocial problems, such as intimate partner violence, pain and opioid use/abuse, and child abuse into both pre-clinical and clinical years. Integrating gun violence into the curriculum can be modeled in a similar way. Since it has been shown that physicians who have training in managing intimate partner violence (IPV) are more likely to screen for it,²¹ it has become a priority in medical education. The same can be done with gun violence.

The biopsychosocial disease model of gun violence can fit into many aspects of the curriculum. First, an understanding of the basics of the physical agent of the disease, in this case kinetic energy from a bullet, can be taught. The basic science of this disease is the biomechanics/ballistics, and what happens to human tissue when a bullet enters. Differences in damage inflicted by different bullets should be considered, for example handgun bullets commonly used in suicides and homicides compared to assault rifles commonly used in mass shootings. We recently documented the energy release of bullets and find it useful in our own education efforts (<https://www.mcw.edu/departments/comprehensive-injury-center/research>).

Just like any other disease, preexisting risks, including adverse childhood events, epigenetics and how these can influence a patient's short- and long-term outcomes can and should be taught. Biological factors (genetic, biochemical, etc.), psychological factors (mood, personality, behavior, other co-existing mental illness), and social determinant factors (cultural, familial, socioeconomic) can all affect the

development of an at-risk patient and should be included. Identifying patients at risk for firearm violence can be taught in a similar way to identifying IPV risks. For example, how medical histories can be used to establish a pattern of violence and using structured questions to obtain important information from the patient²¹ can all be taught.

Courses required at most schools that discuss subjects such as medical ethics, patient communication, clinical problem-solving skills, health promotion and disease prevention, and implications of financial and access issues would be a great opportunity to further integrate gun violence. Important additional aspects of curriculum would be to include identifying, treating, and referring for advocacy, providing community resources, limiting access to lethal means for at-risk patients, providing locks for the safe storage of firearms, and when to appropriately and competently inquire about firearm safety.¹¹

After demonstrating the many factors involved in the BPS model of gun violence, it is important to discuss primary, secondary, and tertiary prevention and treatment strategies. Especially since many victims of firearm injuries do not survive long enough to make it to a hospital, primary prevention, especially for firearm related suicide, needs to be considered and discussed with students. Public and population health on a community-wide scale can also be incorporated, using gun violence as a model for authentic community engagement between hospitals and trauma centers, community organizations, and leaders of civil society. Finally, special challenges and common comorbidities that accompany a firearm injury, such as spinal cord injuries or PTSD, need to be addressed. With discussion of these issues, a comprehensive curriculum on gun violence would also provide the necessary base knowledge to prepare students for residency programs across all specialties.

We fully recognize that changing and/or adding to an already full curriculum is challenging. We also recognize that medical schools are explicitly developing their curriculum to address social and behavioral elements.³³ We feel that what we have recommended are suggestions that could easily be integrated into many different areas of the already established curriculum (see Table 1).

The COVID-19 pandemic has brought to light a need to focus and educate on population health and the psychosocial impact of diseases on society. In medical schools across the

Table 1. Summary of suggested aspects of gun violence education and where they can be integrated into medical school curricula.

Aspect of gun violence	Examples	Established area of curriculum where it could fit
Physical agent of disease	Damage from kinetic energy Biomechanics Ballistics of different bullets	Pathology Musculoskeletal Trauma Care
Identifying risk factors and prevention	Screening questions Adverse childhood events Biopsychosocial model Providing resources to the community	Psychiatry Exam/Interview Skills Medical Ethics
Treatment	First aid for gunshot wounds (i.e. Stop the Bleed) Indications for surgery Mass casualty management	Orientation Surgery clerkship lecture
Complications/care of survivors	PTSD Spinal cord injuries Rehabilitation Lead poisoning	Psychiatry Neurology Medical Ethics Musculoskeletal

country clerkship directors and curriculum deans have been able to quickly adjust material and plans for their medical students, which shows that the curriculum can be flexible, and topics can be added based on what society needs their future doctors to know. This pandemic has demonstrated the necessity to train medical students, who are eager to be capable of providing meaningful help, in the diseases that are most pertinent to society.

Although a public health approach to violence has gained support, notably from the WHO,³⁴ and we encourage medical schools to include it in their curricula, the broader debate surrounding this issue needs to be acknowledged. Critics have noted that programs such as Cure Violence (CV), a Chicago-based program that approaches violence as a disease,³⁵ oversimplify reduce violence to a public health issue. By identifying violence exclusively as a disease, other disciplines (psychology, sociology, politics, economics, criminology) and broader structural factors involved in violence are ignored and potential areas for prevention may be missed.³⁶ We are not advocating for gun violence to be thought of solely as a public health issue, but rather for future physicians to be educated on their role in gun violence management and prevention, which is likely in the public health realm.

Gun violence is a significant and complex problem, adversely affecting patients, families, and communities across the U.S. and the world. Medical school curricula are always changing. New topics should constantly be considered and opportunities to integrate taken. We strongly urge medical schools across the world to address this curriculum gap and train the next generation of physician leaders in all aspects of gun violence and its prevention and control.

Declaration of interest statement

The authors declare that there are no conflicts of interest.

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