Tactical Medicine & Weaponry: The Impact of Assault Rifle Advancements on Emergency Medical Services in the United States

A Research Paper in STS 4600

Presented to the Faculty of the School of Engineering and Applied Sciences University of Virginia • Charlottesville, Virginia

> In Partial Fulfillment of the Requirements for the Degree Bachelor of Science in Biomedical Engineering

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On my honor as a University Student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments

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Introduction

With civilian firearm ownership in the United States exceeding countries plagued by violence and war, the U.S. has consequently endured mass shooting incidents and firearm-related crimes at a rate unparalleled by any other nation. Of the estimated 650 million civilian owned firearms worldwide, nearly half are owned by the U.S. civilian population (Berman, Krause, LeBrun, & McDonald, 2007). Eighteen of the fifty deadliest mass shootings have occurred on U.S. soil—more than quadruple the next leading country (Dillinger, 2019). This proliferating epidemic of gun violence in the U.S. has evolved into an ever-present public safety threat and prompted a national outcry for legislative intervention on the federal level to prevent further carnage. The demand for action was most fervently represented by the 2018 March for Our Lives movement that resulted in over 700 protests across the U.S., organized student walkouts, and mass voter registration (Bond, Chenoweth, & Pressman, 2018).

With the 2004 expiration of the Public Safety and Recreational Firearms Use Act (1994) a federal ban that prohibited the ownership and manufacturing of semiautomatic assault weapons—assault-style weaponry became further integrated into society. This proliferation of assault weapons caused considerable controversy due to their potential threat to public safety within a civilian population (DiMaggio et al., 2019). An upsurge in active shooter incidents and high-profile gun violence events in the early twenty-first century following the ban's expiration demonstrated the existential and inherent danger of assault weapons (Blair & Schweit, 2014; Koper, Woods, & Roth, 2004). The growing threat to public safety surrounding assault weapons has sparked ongoing political debates regarding the implementation of gun control legislation, however, little progress has been made at the federal level.

When discussing assault weaponry, it is critical to consider the societal effect. While it is widely accepted that firearms have a profound impact on society, as is demonstrated by political movements on the topic of gun control, not all societal ramifications are publicly broadcast. In addition to victims and their families who feel the aftermath of gun violence daily, Emergency Medical Service (EMS) personnel are on the front lines of this public safety epidemic. Despite being shunned from the national gun violence conversation by the National Rifle Association (NRA) who urged medical professionals to "stay in their lane," many physicians have publicly stated their perspectives in the gun violence debate with the #ThisISMyLane grassroots movement on social media platforms (Zheng & Mushatt, 2019). EMS personnel and medical professionals are a social group that experience the gun violence epidemic through a unique lens, yet have been largely absent from the media flurry and public discussions on the dangers of assault weaponry. In order to conduct an informed debate at the national level on the necessity of gun control in the U.S., it is critical to understand the technical evolution of assault-style weapons and the consequential impacts on all relevant social groups, particularly overlooked social groups, such as EMS professionals. The post-World War II mass adoption of assault-style weaponry has led to a militarized civilian population and has consequently altered the responsibilities of the U.S. EMS system, making them a relevant social group to consider in this critical social and political debate.

Case Context

Assault rifles were first developed and mass produced by Germany during WWII in an effort to increase loading efficiency and accuracy over long distances (Shurkin, 2016). This advancement in the field of gunsmithing was quickly expanded upon by the Soviets and the British who developed similar assault-style weaponry, thus permanently revolutionizing the method and

lethality of warfare globally (Franko, 2017; Ford, 2008). Military conflicts such as the Korean War prompted U.S. military engineers to develop and mass produce a modified rifle with advanced ballistics and caliber capacity. These developmental tests run by the Operations Research Office and the Ballistics Research Lab of the U.S. military led to the development of the infamous ArmaLite Rifle-15 (AR-15) in 1957 (Shurkin, 2016; Hogg, 2000). The AR-15 was brought to market in 1963 and one of its adaptations, the M16, became the standard infantry rifle of the U.S. military by 1968 (Myre, 2018; Shurkin, 2016). As 21st-century warfare has become more urban and close-range, the U.S. military has transitioned to an M4—short barreled version of the M16 which sacrifices long distance accuracy for movability—however the development of the AR-15 revolutionized weaponry and has led to the militarization of the U.S. civilian population (Shurkin, 2016).

A decline in handgun sales during the 1980s provided gun manufacturers the opportunity to heavily market assault weaponry as a solution to feed the fervor of different consumer populations (Violence Policy Center, 2011). This public fervor for amassing arms was exacerbated by the War on Drugs, Y2K, terrorist attacks of the early 2000s, and natural disasters, all of which incited growing public fear that was exploited by gun manufacturers. Survivalists and political extremists were drawn to the military-style assault weapons as advertisements stressed the antipersonnel effect of this new breed of weapon, see Figure 1 below. The resulting upsurge in assault weaponry ownership around the U.S. caused a parallel increase in fatal events involving firearms, which have occurred with staggering regularity in recent decades with no indication of abatement in the future without legislative intervention. Additionally, recent global health developments surrounding the 2020 coronavirus (COVID-19) pandemic resulted in a spike in firearm sales, with 1.9 million firearms being sold in March 2020—a figure second only to the two million firearms sold the month after the Sandy Hook shooting (Collins & Yaffe-Bellany, 2020). Lobbying tactics by the NRA and the firearm industry similar to those deployed during the 1980s and early 2000s resulted in firearm stores being declared essential businesses equivalent to pharmacies and grocery stores (Collins & Yaffe-Bellany, 2020; Hakim, 2020). This exploitation of public fear by the firearm industry and gun lobby has led to increased civilian armament and illustrates the pervasive nature of the gun culture in the United States where firearms are viewed as essential during a global health crisis.



Figure 1. Advertisements for Civilian Versions of Military Assault Weapons Featured in *Guns* & *Ammo* Magazine from the Mid-1980s. Image reproduced from Violence Policy Center (2011).

Following the expiration of the aforementioned federal assault weapons ban in 2004, the only regulations and legal definitions of assault weapons exist in state and local level legislation. Currently only seven states and the District of Columbia have banned assault weapons, leaving a vacuum of legislative accountability that resulted in an increase in firearm and mass shootingrelated homicides since 2004 (Assault Weapons, n.d.; DiMaggio et al., 2019). The Federal Assault Weapons Ban of 1994 was effective in reducing the number of firearm-related criminal episodes and improving public safety as well as drastically reducing the production levels of assault weapons in the mid-nineties (Koper, Woods, & Roth, 2004). However, in the post-ban era, assault weaponry production has recovered and have contributed to the gun-centric culture of the U.S.

Minimal regulation of assault weapons since their inception in WWII have allowed highpowered, military-style firearms to become increasingly embedded in U.S. civil society. While this espousal of civilian militarization has been controversial at best, the majority of the debate has been framed from physical and political lenses, with violence and Constitutionality being at the forefront of the surrounding public debate (Keaton, 2006). However, with firearms being highly integrated into stereotypical 'American' culture, it is important to view social ramifications with equal or more scrutiny. Numerous social groups have been drastically impacted by the engineering advancements of these deadly weapons, making the problem of gun violence sociotechnical rather than simply political.

Analytical Lenses: Technological Determinism & Citizenship

"The major responsibility for accident prevention rests not with the medical profession, but with educators, industrialists, engineers, public health officials, regulatory officials, and private citizens" (National Academy of Sciences, 1966, pg. 10)

In order to analyze the impact of assault rifle evolution on EMS personnel as a social group within society, the framework of descriptive technological determinism will be utilized. Technological determinism is the theory that historical developments of technological innovation

are the primary driver for social, economic, and political change (Heywood, 2011). Descriptive technological determinism narrows the focus to the overarching idea that technology causes social change and that technological progress is fundamentally intertwined with social progress (Wyatt, 2008; Misa, 1988). Another view of technological determinism is that technological development is autonomous and occurs independent from external or social influences (Misa, 1988). While varying views of technological determinism exist based on the degrees of technological autonomy and influence over surrounding environments, the overarching theory is based in the notion that technological artifacts, such as assault weapons, are capable of influencing social, economic, and political spheres without human intervention (Wengenroth, 1998). These influences include the experiences of EMS personnel who encounter the aftermath of gun violence inflicted by assault weaponry. This framework will facilitate analysis by viewing assault weapons as a determinant technology that has shaped the EMS system in the U.S.

By constructing parallel timelines of assault weaponry development and EMS standardization in the U.S., connections can be drawn between the evolution and integration of high-powered, military-style firearms in the civilian population of the U.S. and an increase in emergency firearm-related events, see Appendix I. Additionally, adapted techniques used by medical professionals to treat firearm-related injuries became a necessity to address the new norm of emergency department visits brought about by the new ballistics' wounds from high-powered firearms (Pinto et al., 2019). This external, technical alteration had drastic effects on the EMS system, therefore, analyzing assault weapons as a determinant technology in the formation and standardization of emergency medicine in the U.S. is critical to understand how EMS professionals are impacted as a relevant social group.

Another evaluative framework that will be used to analyze the sociotechnical relationship between assault weaponry advancements and EMS development in the U.S. is the theory of technological citizenship. This theory evaluates how the rights and duties of citizens within a democratic system are impacted by technological development (Andrews, 2006). Citizen rights are broadly defined as knowledge access, public participation, informed consent, and reasonable risk exposure, while duties include technological literacy, problem engagement, and civic protection (Andrews, 2006). In order to make decisions on technological integration into society, it is critical to analyze the impact of the technology on the democratic society into which it is adopted. For assault weapons, there is inherent risk due to the high-velocity projectile capabilities of firearms which could increase public risk exposure to an unreasonable level and decrease the ability to adequately protect the civic good of communities within the U.S. Additionally, legislative decisions surrounding assault weaponry have impacted technological literacy and problem engagement from the U.S. civilian population. By utilizing this evaluative framework, the impact of assault weapons on overlooked social groups such as EMS personnel can be analyzed from the perspective of democratic citizenship, which will allow for an evaluation of the rights and duties of EMS personnel operating within a heavily armed populace.

This evaluative framework is more reflective of the public discourse surrounding the issue of gun violence and assault weapons within the civilian population of the U.S. since most of the debate has been centered in the political sphere. Gun rights activists have argued that the Second Amendment offers blanket protection to all firearms for citizens regardless of engineering advancements and lethality. This interpretation was upheld by the landmark Supreme Court cases *United States v. Miller* (1939) where the ruling stated constitutional protections extended to firearms "in common use" and *District of Columbia v. Heller* (2008) where the D.C. handgun ban

was overturned for firearms "unconnected with service in a militia" and that self-defense in the home was among the "traditional lawful purposes". These rulings create a dichotomy for firearms between "common" and "typical" firearms that are interpreted to be protected, and "dangerous and unusual," which has been interpreted to be automatic weapons that were already banned in the U.S. (Kopel, 2015, pg. 870). These cases, along with the Staples v. the United States (1994) which stated that the AR-15 was the civilian version of the M16, have shaped modern interpretations of the Second Amendment. The rulings trend towards the agendas of Constitutional originalists and have prevented effective enforcement of gun-control legislation at the federal level. By viewing landmark legislative actions at the state and federal level that have contributed to the unabated spread of assault weapons in the U.S. civilian marketplace and communities, the social impact on different actor groups can be viewed through the lens of technological citizenship. EMS professionals operate within a democratized society; however, their experiences are shaped by emergencies, many of which are firearm-related. Therefore, the rights and duties of citizens and political figures have a clear impact on EMS professionals that has been overlooked, suppressed, or actively ignored in this public debate.

Research Question & Methods

The research question motivating this paper is: How have assault weapon advancements post-WWII impacted the development of the EMS system in the U.S.? In order to evaluate and analyze causational overlaps through the evaluative frameworks of technological determinism and citizenship, a timeline of assault weapon advancements and EMS development was constructed and relevant keyword searches and numerical data were compiled, see Figure 2.



Figure 2. Human, Social, and Technical Connections of Assault Weaponry Advancement and the Emergency Medical Service System in the United States. A demonstration of the analytical methods and motivations for this sociotechnical analysis (Image source: DuCharme, 2019).

Timeline of Assault Weapon Advancement

To construct a timeline of assault weapon development and proliferation in the U.S., journal articles documenting firearm history were used to identify landmark events and precursors to weapons in circulation today. Dates of federal and state-level legislative actions provide context for the U.S.' democratic policy with respect to firearms in the post-WWII era. Technological determinism analysis was used to illustrate how assault weapons have the capacity to mold the social setting in which they exist, with emergency response procedures being altered in response to the increased frequency of firearm-related wounds. Technological citizenship analysis was used to evaluate the legislative decisions that impacted civilian access to assault weapons and consequently altered the role of EMS professionals.

Timeline of EMS Development and Standardization in the United States

Journal articles documenting the history of emergency services in the U.S. and relevant legislative actions were compiled to catalog the formation of the EMS. This timeline includes landmark publications that contributed to the standardization of EMS training and procedures—a development in the post-WWII era that defined the formation of a formal, nationwide emergency response system. Additionally, this timeline provides important dates regarding tourniquet usage, since they are medical devices used to control hemorrhagic injuries, specifically related to gunshot wounds. This timeline, in parallel with the assault weapon advancements timeline, demonstrates how mainstream proliferation of military-style firearms have impacted the EMS system's development and societal role.

Keyword Searches

Terms related to assault weapons, gun violence, and the EMS system were used in a series of keyword searches to demonstrate the social and political effects of assault weapon proliferation in the U.S. The searches included terms related to automobile fatalities as they were a driving factor in the 1960s toward the development of a formal EMS system in the U.S. Keyword searches were conducted across Google® searches, presidential speeches, and documents from hospitalbased violence intervention programs (HBVIPs) across the U.S. HBVIPs are preventative action programs that aim to decrease and address violent injury and have been shown to reduce health and financial costs (Purtle, Rich, Bloom, Rich, & Corbin, 2015). HBVIPs were selected as a case study to illustrate the evolving relationship between emergency medicine and violent crime. Google® searches and presidential speeches were selected as comparative analyses of public and governmental attention to the issue of gun violence.

Numerical Data

Using data from the National Highway Traffic Safety Administration and the Centers for Disease Control and Prevention (CDC), fatality counts for automobile and firearm-related deaths during the years 1950-1959 and 2008-2017 respectively were compared to illustrate the magnitude of the gun-violence epidemic in the U.S. Additionally, data from the CDC and the National Registry of Emergency Medical Technicians was compiled to illustrate the ratio of EMS professionals and firearm-related deaths by state, which was analyzed for possible relevant trends.

Results

The rapid development and adoption of assault weapons in the firearm culture in the U.S. created a heavily-armed civilian populace and forced the militarization of the EMS system. This resulted in combat casualty care (CCC)-style EMS procedures being integrated into civilian casualty care. Escalating gun violence has all the hallmarks of a public health crisis capable of prompting federal intervention; however, legislative action remains minimal as does state-level policymaking. The findings of this research indicate ramifications for EMS professionals such as: alterations to emergency protocols, HBVIP development, and the emergence of tactical emergency medical service (TEMS) units in a peacetime, civilian setting.

Timeline Trends

Based on the assault weapons advancement timeline, the United States' history with firearms is long standing and complex, see Appendix A. The advent of the assault rifle in WWII and the subsequent militarization of the civilian arms market resulted in a growing acceptance of military-style weapons in civilian culture, which is evident in ammunition capacity laws becoming increasingly lenient. However, a series of twentieth-century legislative actions by the states indicate that assault weapons can be restricted based on firing and magazine capacity. In contrast, landmark Supreme Court cases have upheld originalist interpretations of the Second Amendment, virtually assuring that assault weapons remain under the umbrella definition of firearms "in common use," which are protected (United States v. Miller, 1939).

The timeline of EMS development and standardization indicates militarization trends that can be attributed to the increase in violent crime associated with the proliferation of assault weapons. Automobile fatalities were a driving force in the formation of a standardized EMS; however, accidental deaths and violent crime played a pivotal role in refining EMS procedures. The most notable influence from assault weapons is the changing acceptance of tourniquet use in casualty treatment. Tourniquets were excluded from medical doctrine due to their association with gangrene and amputation in the Civil War era, however, hemorrhagic bleeding from gunshot wounds led to their re-adoption into the military combat theater in the early 2000s (Welling, McKay, Rasmussen, & Rich, 2012). Following the Sandy Hook mass shooting, a meeting between physicians, military leaders, and law enforcement—the Hartford Consensus—convened and created the "Stop the Bleed" movement, which encouraged the uses of tourniquets to control hemorrhagic bleeding in civilian trauma care (Williams, 2019). This development illustrates the changing nature of emergency response in civilian casualty care based on gun violence episodes.

Keyword Searches

Public Attention Comparison via Google Trends®

Public attention to gun violence is occurring with increasing frequency, but appears to primarily coincide with mass shooting events, indicating conditional public attention, see Figure

13

3. Contrastingly, public attention to the EMS system has been stagnant or declining over the same time period, which suggests minimal correlation between the two topics. However, this mutual exclusivity is refuted by the parallel timelines and is indicative of cultural priorities.



Figure 3. I) Search Interest for Keywords from Google Trends® Related to Gun Violence in the United States. Key events are marked on this timeline to provide context for trends in keyword searches. II) Search Interest for Keywords from Google Trends® Related to Emergency Medical Services in the United States. Interest is ranked relative to the highest point: 100 is peak popularity, 50 is half as popular, and 0 means that data is unavailable. Searches from 2004-present, inclusive.

Presidential Speeches

Keyword	Presidential Speeches	Year	Administration	Times Mentioned
"Mass Shooting"	Remarks on Sandy Hook Elementary Shootings	2012	Barack Obama	1
	State of the Union Address	2016	Barack Obama	1
	Remarks in Eulogy for the Honorable Reverence Clementa Pickney		Barack Obama	2
"C V' 1 "	State of the Union	2014	Barack Obama	1
"Gun Violence"	Speech on Gun Violence	2013	Barack Obama	7
	Statement on the Government Sequester	2013	Barack Obama	1
	State of the Union	2013	Barack Obama	3
	State of the Union	1994	Bill Clinton	1
	Speech on Gun Violence	2013	Barack Obama	1
	Remarks to the Congregation of St. Paul's AME Church	1996	Bill Clinton	1
	Presidential Debate with Senator Bob Dole	1996	Bill Clinton	11
66 A 1/ 337 33	State of the Union Address	1996	Bill Clinton	2
"Assault Weapon"	Address on Race Relations	1995	Bill Clinton	1
	State of the Union Address	1995	Bill Clinton	2
	State of the Union Address	1994	Bill Clinton	1
	Remarks to the Convocation of the Church of God in Christ in Memphis	1993	Bill Clinton	1
"Automobile Accident"	-	-	-	-
"Car Crash"	-	-	-	-
"Traffic Accident"	-	-	-	-
"Emergency Medical Service"		-	-	-
	Statement on the School Shooting in Parkland Florida	2018	Donald Trump	1
"First Responders"	Remarks on Combating the Opioid Crisis	2018	Donald Trump	3
	Speech at the Veterans of Foreign Wars National Convention	2018	Donald Trump	1
	Remarks on Sandy Hook Elementary Shootings	2012	Barack Obama	2
	Address to Congress on the American Jobs Act	2011	Barack Obama	1
	Remarks at Memorial for Victims of the Tucson, AZ Shooting	2011	Barack Obama	1
	Hurricane Relief Address from New Orleans	2005	George W. Bush	1
	State of the Union Address	2005	George W. Bush	1
	Remarks at the Republican National Convention	2004	George W. Bush	1
	State of the Union Address	2003	George W. Bush	1

Table 1. Frequency of Neyword Abbearances in Presidential Speeche	Table 1.	Frequency	of Kevw	ord Appea	rances in	Presidential	Speeches
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All mentions of gun violence-related keywords in presidential speeches have occurred in the past thirty years, exclusively by Democratic administrations, see Table 1. The one-sided presidential rhetoric suggests strict partisan divides on the gun violence epidemic, which is indicated as a pillar of both parties' platforms. However, the pervasive nature of gun violence episodes throughout the U.S. demonstrates that outcomes of inaction are not similarly divided.

^{1.} Data collected from Presidential Speeches archive in the Miller Center (2017) at the University of Virginia.

President John F. Kennedy declared on the 1960 presidential campaign trail that "Traffic accidents constitute one of the greatest, perhaps the greatest of the Nation's public health problems," yet terms related to automobile fatalities are absent from presidential speeches despite traffic crashes being a catalytic campaign platform that instigated the development of the EMS system in the 1960s (Moynhan et al., 1968, pg. 11). Regardless, medical programs flourished in the 1960s, primarily due to the landmark publication in 1966 entitled *Accidental Death and Disability: The Neglected Disease of Modern Society*—where shortcomings of the EMS system were exposed and suggestions for improvement were made (Shah, 2006; National Academy of Sciences, 1966). Similarly, aside from occasional recognition for their life-saving efforts, EMS professionals have not received comparable presidential attention.

HBVIP Documentation

Table 2. Frequency of Keyword Appearances in Documents Relevant to Hospital-Based Violence Intervention Programs (McNamee, Coldren, & Sun, 2018; Children's Wisconsin, 2020; Becker, Calhoun, Feldman, & Karraker, 2009).

Program Title	Location	Year Established	Document	Document Type	Keywords	Times Mentioned
					"Firearm"	1
PIVOT Atlanta, Georgia	Atlanta		Strategies for Policy Innovation	Newsletter	"Gunshot"	7
	Gaorgia	2018			"Gun Violence"	12
	Georgia				"Emergency Medical Services"	1
					"Firearm"	0
Project Mi Ujima W	NC1 1	1995	Addressing violence: Project Ujima	Online Information Page	"Gunshot"	1
	Wisconsin				"Gun Violence"	0
	w isconsiii				"Emergency Medical	0
					Services"	
			Caught in the Crossfire: A		"Firearm"	1
Caught Oak in the Calin Crossfire	Oakland,	Oakland, 1994 California	intervention program for violently injured youth	Program Manual	"Gunshot"	3
					"Gun Violence"	5
	Camolilla				"Emergency Medical Services"	0

Emergency services are compensating for the lack of legislative assistance through the development of HBVIPs. PIVOT, Project Ujima, and Caught in the Crossfire all mention terms related to gun violence, indicating that it is a motivation behind these programs, see Table 2. Contrastingly, the term related to the EMS returned minimal results across all programs. Caught

in the Crossfire was the first formal HBVIP in the U.S., and in 2009, the group Youth ALIVE! convened to create the National Network of HBVIPs, a group now known as the Health Alliance for Violence Intervention (HAVI) (The Health Alliance for Violence Intervention, 2019). The formation of HAVI illustrates the evolving role of the EMS in violent crime. EMS professionals and healthcare workers are no longer solely responsible for emergency treatment, but for active prevention and tactical intervention.

Numerical Data



Automobile v. Firearm-Related Fatalities

Figure 4. Fatality Count Comparison Between Automobile Fatalities in the 1950s² and Firearm-Related Deaths from 2008-2017³. Automobile fatalities defined as death occurring within 30 days of a traffic crash (National Highway Traffic Safety Administration, 2019). Data includes suicides by firearms.

Despite the lack of presidential speech time awarded to automobile fatalities, the number of traffic crashes in the 1950s managed to instigate federal action to formally develop and standardize a national EMS system. The number of automobile deaths during the 1950s rose from

^{2.} Data on automobile deaths collected from National Highway Traffic Safety Administration (2019).

^{3.} Data on firearm-related fatalities was collected from Kochanek, Murphy, & Xu (2015), Kochanek, Murphy, Xu, & Arias (2019), Kochanek, Murphy, Xu, & Tejada-Vera (2016), Kochanek., Xu, Murphy, Miniño, & Kung, (2011), Miniño, Murphy, Xu, & Kochanek (2011), Murphy, Kochanek, Xu, & Heron (2015), Murphy, Xu, & Kochanek (2013), Murphy, Xu, Kochanek, Curtin, & Arias (2017), Xu, Murphy, Kochanek, & Bastian (2016), and Xu, Murphy, Kochanek, Bastian, & Arias (2018).

approximately 33,000 deaths to over 37,000, see Figure 4. In comparison, firearm-related fatalities from 2008-2017 have surpassed the number of automobile deaths that prompted a declaration of a national "public health problem" in the 1960s that resulted in the modern EMS system (Moynhan et al., 1968, pg. 11). The magnitude of firearm-related fatalities suggests a need for intervention in order to prevent the exacerbation of the gun violence epidemic.



Firearm Fatality and EMS Personnel Prevalence by State

Figure 5. I) Heat Map of Firearm-Related Fatalities by State Normalized by State Population for the Year 2017⁴. II) Heat Map of Emergency Medical Services Personnel Population by State Normalized by State Population (data from January 29th, 2020)⁵.

The number of EMS professionals normalized by state population illustrates their nationwide distribution, see Figure 5. Montana has the highest ratio of EMS personnel in the U.S. and New York has the lowest, which would be a product of urban versus rural settings. Similarly, when comparing the number of firearm fatalities normalized by state population, Montana has the highest ratio and New York has the second lowest, which could be a product of firearm ownership, however there are no formal nationwide registries of gun ownership for comparison and analysis. States with existing assault weapons bans—New York, Massachusetts, Connecticut, California,

^{4.} Data collected from the Centers for Disease Control and Prevention (2019).

^{5.} Data collected from the National Registry of Emergency Technicians (2018).

Hawaii, Maryland, and New Jersey—are on the lower end of the firearm-fatalities spectrum. This suggests legislative efficacy in reducing the prevalence of gun violence and elevating levels of public safety.

Discussion

Increased militarization has resulted in U.S. law enforcement and first responders being outgunned by the civilian populace. Consequently, EMS personnel have adopted CCC tactics and become integral to tactical law enforcement units, resulting in the widespread use of TEMS for civilian casualty care (Vayer & Schwartz, 2003). EMS professionals respond to violent crime in a manner comparable to law enforcement and are often armed, which requires tactical medics to complete additional training and shoulder the burden of personal defense with a deadly weapon while attempting to fulfill their duty as lifesaving professionals. Consequently, EMS personnel can experience psychological ramifications from treating trauma victims, such as secondary traumatic stress or vicarious trauma (Gordon, 2018).

Despite being an integral social group in the gun violence epidemic, EMS personnel have been largely excluded from this nationwide conversation, as indicated in the analysis of public attention and presidential statements. While gun violence proliferation has clearly altered the EMS approach to treating and attending to firearm-related injuries, public attention to the issue has been sporadic at best. Google Trends® indicates attention to this public safety crisis primarily coincides with high-profile episodes that garner significant media attention instead of eliciting consistent public concern, see Figure 3. This lack of continuous public attention to the issue of gun violence is also a result of how the U.S. chronicles its history of high-profile gun violence incidents. Mass shootings in the United States are labeled after their locations (i.e. Columbine, Sandy Hook, Virginia Tech, Las Vegas, Pulse, San Bernardino, Navy Yard, etc.) rather than their dates of occurrence, which prevents widespread recognition of the frequency and prevalence of gun violence. Contrastingly, the 2011 terrorist attacks in Norway that left 77 people dead—8 from a bomb in the government district of Oslo and 69 in a shooting at a summer camp on Utøya island— went down in history as the 22 July attacks (Thoresen et al., 2012). This attack was the deadliest mass shooting by a lone gunman in global history (Herring & Jacobson, 2015). Consequently, its response in Norway has been comparable to the September 11th terrorist attacks in the United States—a date synonymous with terror and suffering (Thoresen et al., 2012). If the U.S. treated the issue of gun violence as domestic terrorism, or acknowledged the frequency of mass shooting anniversaries, perhaps cultural attitude and public attention towards gun violence would be more consistent and productive.

In contrast to the highly conditional public view, gun violence has received significant democratic presidential attention which suggests a public safety issue of equal or greater magnitude than automobile fatalities in the 1950s, see Table 1. This conclusion is also reflected in the comparative data set between automobile and firearm-related fatalities for their respective time periods, see Figure 4. While gun violence has grown in prevalence, there has been little federal action to address the violence or the ramifications for social groups such as the EMS.

Changing responsibilities of EMS professionals could result in inconsistent levels of public safety, which is demonstrated by the heat maps of firearm fatalities and EMS prevalence, see Figure 5. Assault weapons have shaped aspects of civilian casualty care by trending towards combat methods in order to reach victims during active shooter incidents and address the wounds requiring treatment from assault weapons. These changes illustrate how assault weapons have acted as a determinant technology: shaping the environment in which they operate.

Evolving roles and responsibilities of EMS professionals as a social group are indicative of changing societal perception of citizen rights and duties based on prevalent and pervasive technologies. Assault weapons have resulted in the right to reasonable level of risk exposure changing for EMS personnel as indicated by the formation of TEMS and the adoption of armed paramedics. Similarly, the duties of EMS professionals have changed because "protecting the civic good" is becoming increasingly difficult and dangerous due to the presence of assault weapons (Andrews, 2006, pg. 4).

Limitations to this research include an overall lack of data on firearm ownership across U.S. citizens and available research by federal organizations. Legislative barriers such as the 1996 Dickey Amendment—which prohibits the use of federal funding for the CDC to be used to promote gun control-have inhibited gun violence research, making evidence on the role of assault weapons in this public safety epidemic difficult to obtain (Rostron, 2018). Additionally, when conducting research for this paper, limitations were encountered during data compilation. For keyword searches on presidential speeches, terms were searched digitally from UVA Miller Center Presidential Speeches archive; the original speeches were not perused in detail and selected terms were limited due to the digital recognition requirement—terms must be standalone and not part of other words. Another limitation involving keyword searches was the source selection. Presidential speeches were selected due to their indication of partisan divides on the gun violence epidemic; however, presidential speeches are used to address the nation and stabilize the nation in times of violence and fear, which introduces ulterior motives that can override the use of factual evidence in the speeches. The speeches were included in the research regardless because this inherent bias reveals strict partisan divides on this issue of gun violence and further suggests incongruency in partisan responses and potential solutions.

Future studies on this topic could be elevated by data sets from nonpartisan federal agencies or by testimonies from EMS professionals on their personal experiences treating firearm-related injuries. Expanding the scope of keyword searches to other forms of documentation such as police reports or internal hospital documents could also elevate this research by providing a more complete assessment of national attention to the gun violence issue. Additionally, expanding this style of sociotechnical analysis to other overlooked social groups affected by the proliferation of assault weapons in this U.S. could provide valuable insight into the scope of this issue and lend a voice to underrepresented demographics in this national discourse. Interesting sociotechnical analyses could be conducted on social groups delineated by occupation (i.e. law enforcement, teachers, etc.), race, age, nationality, gender, socioeconomic status, etc. Countless social groups experience the gun violence epidemic and proliferation of assault weapons in the U.S. differently, and in order to effectively address the public safety threat, social ramifications must be thoroughly understood.

This evaluative approach is critical for engineers because technologies operate within a social and political sphere and have the power to create substantial change. This sociotechnical research will advance my engineering practice by engaging empathy in technical problem solving. The recognition that technologies have social and political ramifications and affect social groups differently is key to responsible innovation, particularly in the field of biomedical engineering where most devices interact with humans to a significant degree. I believe that this research will elevate my ability to identify overlooked social groups that could be impacted by the technologies I engineer and more deeply consider how my actions in the technical sphere can manifest social change deterministically or democratically.

Conclusion

The gun violence epidemic is a highly-politicized hallmark of the twenty-first century due to the prevalence of high-profile shooting incidents. The most notorious weapons contributing to this epidemic-assault weapons-originated during WWII and subsequently proliferated within the civilian population of the U.S., feeding the gun culture synonymous with 'Americans.' This burgeoning public health crisis shows few signs of abatement and affects countless social groups in unique ways. In order to engage in productive discourse on this issue and work toward a viable, nationwide solution that prioritizes public safety without infringing on Constitutional rights, it is critical to consider the effects of assault weaponry on overlooked social groups, such as EMS personnel. EMS roles and responsibilities have evolved due to the integration of assault weapons into civilian communities, resulting in the militarization of the EMS system. These changes demonstrate how assault weapons have functioned as a determinant technology for the EMS system and how the rights and duties of EMS personnel have evolved due to their presence within our society. Using these evaluative frameworks to analyze sociotechnical relationships can contextualize the role of technology in society and allow citizens to make informed decisions on societal issues. Understanding the scope of societal impact is the responsibility of citizens and politicians nationwide and is the first step towards a future free of mass shootings and small-scale gun violence episodes.

Appendix A. Timeline

Table 3. Timeline of Landmark Events in the Development and Regulation of Assault Weapons and the Formation and Standardization of the United States' Emergency Medical Services System⁶

Assault Weapons	Year	Emergency Medical Services
16-shooter developed: 1 st known firearm able to fire more than 10 rounds without reloading	1580	
	1674	Tourniquets adopted during the Franco-Dutch War to control bleeding
U.S. ratifies Second Amendment	1791	
	1861	Emergency medical support established in the combat theater of the Civil War to move wounded soldiers
	1865	Tourniquets abandoned in medical doctrine due to their association with amputation and gangrene
	1918	United States republishes <i>Injuries and Diseases of War</i> from British with negative statements about tourniquets
	1922	American College of Surgeons' (ACS) Committee on Trauma established
Michigan prohibits "any machine gun or firearm which can be fired more than 16 times without reloading"	1927	
Rhode Island bans "any weapon which shoots more than 12 shots semiautomatically without reloading"		
M1 Garand developed by the United States	1928	
District of Columbia prohibits the possession of a firearm that "shoots automatically or semiautomatically more than 12 shots without reloading"	1932	
Ohio requires special permit for possession or sale of a semiautomatic firearm with an ammunition capacity greater than 18 rounds	1933	
Congress enacts National Firearm Act to regulate machine guns United States v. Miller Supreme Court Decision interprets the original meaning of the Second Amendment as protecting individually-owned firearms "in common use at the time"	1934 1939	
Sturmgewehr (StG) 44 developed by the Germans	1942	
Avtomat Kalashnikov 47 (AK-47) developed by the Soviet Union	1944	Public Health Service Act of 1944 passes
Experimental Model (FM) 2 Rifle developed by the British	1948	
Experimental moder (EM) 2 rene developed by the British	1958	Peter Safar publishes landmark paper detailing initial cardiopulmonary resuscitation (CPR)
Michigan firearm ban repealed Rhode Island ammunition capacity law changed to 14 shots	1959	
	1960	Democratic party platform emphasizes need for heart disease and cancer treatment President Kennedy declares traffic accidents in the United States as a major public health problem
Civilian Marksmanship Program created by U.S. Congress and supplies citizens with nearly a quarter million M1 carbine ⁷ rifles ArmaLite Rifle 15 (AR-15) brought to market M16 developed by the United States	1963	
· · · · · · · · · · · · · · · · · · ·	1964	President Johnson develops Regional Medical Programs (RMPs) to address heart disease, cancer, and stroke
	1965	Congressional leaders publicly acknowledge the increasing health and financial costs of trauma President Johnson creates President's Commission on Highway Safety ACS conducts its first course for ambulance personnel

^{6.} Timeline compiled using data from Blackwell (2019), Bucher & Zaidi (n.d.), District of Columbia v. Heller (2008), Ford (2008), Gun Control Act (1968), Investigative Assistance for Violent Crimes Act (2013), Kopel (2015), Krouse & Richardson (2015), Public Safety & Recreational Firearm Use Act (1994), Rockwood, Mann, Farrington, Hampton, & Motley (1976), Rostron (2018, Safar (1958), Shah (2006), Shurkin (2016), Staples v. United States (1993), United States v. Miller (1939, Vayer & Schwartz (2003), and Welling, McKay, Rasmussen, & Rich (2012).

^{7.} Carbine is a lightweight, short-barreled version of a long-gun. The term originated from the French *carabine* and are typically used as supplementary military arms due to their ease of use in comparison to bulkier weapons (Carbine, 2019).

	1966	National Academy of Sciences publishes landmark document Accidental Death and Disability: The Neglected Disease of Modern Society criticizing the quality of emergency care in the United States
Gun Control Act of 1968 passes prohibiting the importation of firearms into the United States with exceptions for sporting	1968	Highway Safety Act published National attempt to standardize ambulance attendant training
lirearms	1969	Department of Transportation-National Highway Traffic Safety Administration contracted to develop a standardized course of instruction for Emergency Medical Technicians <i>Ambulance Design Criteria</i> published
	1970	National Registry of Emergency Medical Technicians established Coalition of federal departments develop the Military Assistance to Safety and Traffic Program which explores the feasibility of using military helicopters and service paramedic personnel in civilian medical emergencies
Ohio ammunition capacity law changes to 32 rounds	1971	Television show "Emergency" depicts EMS personnel rescuing
	1973	Emergency Medical Systems Act passes and amends Public Health Service Act of 1944 President Nixon eliminates Division of Emergency Health Services and RMPs
Rhode Island ammunition capacity laws fully repealed	1975	
	1981	Omnibus Budget Reconciliation Act restructures funding for the EMS and integrates EMS programs into Health Prevention Block Grants
	1982	National Tactical Officers Association calls for the inclusion of paramedics on tactical teams
	1984	Emergency Medical Services for Children Program developed to improve care for pediatric patients
New Jersey bans magazines over 15 rounds	1990	
Hawaii bans handgun magazines over 20 rounds	1992	
Hawaii ammunition capacity law reduced to 10 rounds	1993	
Public Safety and Recreational Firearms Use Protection Act passed to ban the possession, sale, and manufacture of semiautomatic assault weapons Maryland bans the sale or manufacture of magazines over 20	1994	
rounds Staples v. United States Supreme Court Decision describes the AR-		
15 as the "civilian version of the military's M16 rifle"	100.0	
California hans the sale of magazines over 10 rounds	1996	Dickey Amendment passes
New York bans the sale of magazines over 10 rounds	2000	
Public Safety and Recreational Firearms Use Protection Act expires without renewal	2004	Joint Theater Trauma System implemented in Iraq and Afghanistan confirms the utility of tourniquets and leads to them being standard issue for the United States military
District of Columbia v. Heller Supreme Court Decision rules the District of Columbia's handgun ban of 1975 unconstitutional because handguns are "in common use"	2008	
C C	2009	National Network of Hospital Based Violence Intervention Programs established
Investigative Assistance for Violent Crimes Act passes and redefines the legal definition of a mass shooting as 3 or more fatalities in one or more geographically proximal locations Colorado bans magazines over 15 rounds Connecticut bans magazine over 10 rounds	2013	Hartford Consensus convenes after the Sandy Hook mass shooting and adopts the military approach (tourniquets) to controlling external hemorrhage in a civilian emergency setting, resulting in the "Stop the Bleed" movement
Maryland ammunition capacity law reduced to 10 rounds New York ammunition capacity law reduced to 7 rounds Obio licensing law fully repealed	2014	
onio neensing iaw runy repeated	2014	<u> </u>

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Appendix C. Conference Poster

Of the estimated 650 million civilian-owned firearms worldwide,

mass adoption of assault-style weaponry has led to a militarized civilian

population and has consequently altered the responsibilities of the U.S.

EMS system, making them a relevant social group to consider in this

In order to evaluate and analyze causational overlaps of assault weapon

and EMS development in the post-WWII era, a series of research

· Parallel timelines of assault weaponry advancement and EMS

and how the EMS services adapted and militarized in response.

Keyword searches related to assault weapons, gun violence, and

the EMS system were conducted to demonstrate the social and

political effects of assault weapon proliferation in the U.S. Searches

were conducted across Google® searches, presidential speeches,

and documents from hospital-based violence intervention programs

(HBVIPs) across the U.S. The former sources were selected to

demonstrate the variance in public and presidential attention to

proliferating gun violence, and HBVIPs were selected as a case study to illustrate the evolving relationship between emergency

Numerical data was compiled to illustrate the magnitude of the gun

violence epidemic in the U.S. and how the EMS system is

distributed across the country. Using data from the National

Highway Traffic Safety Administration and the Centers for Disease

Control and Prevention (CDC), fatality counts for automobile and

firearm-related deaths were compared to illustrate the capacity of

the gun-violence epidemic in the U.S. to prompt federal legislative

intervention. Additionally, data from the CDC and the National Registry of Emergency Medical Technicians was collected to illustrate the ratio of EMS professionals and firearm-related deaths by state, which was analyzed for possible relevant trends

Data was then analyzed using the evaluative frameworks of technological determinism and citizenship to analyze how assault

weapons acted as a determinant technology in the formation and

militarization of the EMS and how the rights and responsibilities of

formation were constructed to demonstrate how the U.S.'

democratic relationship with firearms evolved in the post-WWII era

critical social and political debate

medicine and violent crime

EMS professionals changed in response.

Methods

methods were utilized:

Tactical Medicine & Weaponry: The Impact of Assault Rifle Advancements on Emergency Medical Services in the United States



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Introduction

Data Analysis

Parallel Timelines

nearly half are owned by the U.S. civilian population1. Eighteen of the fifty deadliest mass shootings have occurred on U.S. soil-more than Based on the timeline of assault weapons advancement, the United quadruple the next leading country2. This proliferating epidemic of gun States' history with firearms is long standing and complex. The advent violence in the U.S. has evolved in the post-World War II era into an of the assault rifle occurred in Germany during WWII and cascaded ever-present public safety threat. The existential and inherent danger of through competing military interests to form a global arsenal of high assault weapons manifested following the expiration of the Public powered firearms that made their way to civilian markets in the U.S Safety and Recreational Firearms Use Act of 1994 with an upsurge in The subsequent militarization of the civilian arms market resulted in active shooter incidents and high-profile gun violence episodes that a growing acceptance of military-style weapons in civilian culture, unfolded in the U.S. in the early twenty-first century3,4. While it is which is evident in state-level ammunition capacity laws becoming widely accepted that firearms have a profound societal impact, not all increasingly lenient. However, a series of twentieth-century societal ramifications are publicly broadcast. In addition to victims and legislative actions by the states indicate that assault weapons can be their families who feel the aftermath of gun violence daily, Emergency restricted based on firing and magazine capacity. In contrast, landmark Medical Service (EMS) personnel are on the frontlines of this public Supreme Court cases have upheld originalist interpretations of the safety epidemic. In order to conduct an informed debate at the national Second Amendment, virtually assuring that assault weapons remain level on the necessity of gun control in the U.S., it is critical to under the umbrella definition of firearms "in common use," which are understand the technical evolution of assault-style weapons and the protected5. consequential impacts on all relevant social groups, particularly overlooked social groups, such as EMS professionals. The post-WWII

The timeline of EMS development and standardization indicates militarization trends that can be attributed to the increase in violent crime associated with the proliferation of assault weapons. Automobile fatalities were a driving force in the formation of a standardized EMS; however, accidental deaths and violent crime played a pivotal role in refining EMS procedures. The most notable influence from assault weapons is the changing acceptance of tourniquet use in casualty treatment. Tourniquets were excluded from medical doctrine due to their association with gangrene and amputation in the Civil War era, however, hemorrhagic bleeding from gunshot wounds led to their re-adoption into the military combat theater in the early 2000s6. Following the Sandy Hook mass shooting, a meeting between physicians, military leaders, and law enforcement-the Hartford Consensus-convened and created the "Ston the Bleed" movement, which encouraged the uses of tourniquets to control hemorrhagic bleeding in civilian trauma care7. This development illustrates the changing nature of emergency response in civilian casualty care based on gun violence episodes.

Numerical Data



Figure 1, Fatality Count Comparison Between Automobile Fatalities in the 1950s and Firearm Figure 1 Patienty Count Comparison between Automobile Patientes in the 1950s and Figure Related Deaths from 2008-2017. Automobile fatalities defined as death occurring within 30 days of a traffic crash. Data includes suicides by firearms.



Figure 2. 1) Heat Map of Firearm-Related Fatalities by State Normalized by State Population for the Year 2017. II) Heat Map of Emergency Medical Services Personnel Population by State malized by State Population (data from January 29th, 2020).





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Keyword	Presidential Speeches	Year	Administration	Times Mentioned	
ss Shooting"	Remarks on Sandy Hook Elementary Shootings	2012	Barack Obama	1	
	State of the Union Address	2016	Barack Obama	1	
	Remarks in Eulogy for the Honorable Reverence Clementa Pickney	2015	Barack Obama	2	
	State of the Union	2014	Barack Obama	1	
n violence.	Speech on Gun Violence	2013	Barack Obama	7	
	Statement on the Government Sequester	2013	Barack Obama	1	
	State of the Union	2013	Barack Obama	3	
	State of the Union	1994	Bill Clinton	1	
ault Weapon"	Speech on Gun Violence	2013	Barack Obama	1	
	Remarks to the Congregation of St. Paul's AME Church	1996	Bill Clinton	1	
	Presidential Debate with Senator Bob Dole	1996	Bill Clinton	11	
	State of the Union Address	1996	Bill Clinton	2	
	Address on Race Relations	1995	Bill Clinton	1	
	State of the Union Address	1995	Bill Clinton	2	
	State of the Union Address	1994	Bill Clinton	1	
	Remarks to the Convocation of the Church of God in Christ in Memphis	1993	Bill Clinton	1	
utomobile Accident"				-	
ar Crash''					
fic Accident"					
mergency ical Service"					
	Statement on the School Shooting in Parkland Florida	2018	Donald Trump	1	
	Remarks on Combating the Opioid Crisis	2018	Donald Trump	3	
	Speech at the Veterans of Foreign Wars National Convention	2018	Donald Trump	1	
	Remarks on Sandy Hook Elementary Shootings	2012	Barack Obama	2	
	Address to Congress on the American Jobs Act	2011	Barack Obama	1	
Responders"	Remarks at Memorial for Victims of the Tucson, AZ	2011	Barack Obama	i	

HBVIP Documentation

tate of the Union Addres

Table 2. Frequency of Keyword Appearances in Documents Relevant to Hospital-Based Violence

Program Title	Location	Year Established	Document	Document Type	Keywords	Times Mentioned
PIVOT	Atlanta, Georgia	2018	Strategies for Policy	Newsletter	"Firearm" "Gunshot" "Gun Violence"	1 7 12
Grouga	0101012				"Emergency Medical Services"	1
				Online	"Firearm" "Gimahot"	0
Project Milwa Ujima Wisco	Milwaukee,	1005	Addressing violence: Unime Project Ujima Page	Information	"Gun Violence"	ô
	Wisconsin			Project Ujima	Page	"Emergency Medical Services"
			Caught in the Crossfire: A		"Firearm"	1
Caught O in the Ca Crossfire	Oakland,	1004	peer-based hospital intervention program for violently injured youth	Program Manual	"Gun Violence"	5
	California				"Emergency Medical Services"	0

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Results

The rapid development and cultural adoption of assault weapons in the US created a heavily-armed civilian populace and militarized EMS system- resulting in combat casualty care (CCC)-style emergency response procedures being used in civilian casualty care. Escalating gun violence appears to have all the hallmarks of a public health crisis capable of prompting federal intervention, however, legislative action remains minimal and state-level. Additionally, ramifications for EMS professionals are readily observed throughout the findings of this research including; alterations to emergency protocols, HBVIP development, and the emergence of tactical emergency medical service (TEMS) units in a peacetime, civilian setting.

Public attention to gun violence is occurring with increasing frequency, but appears to primarily coincide with mass shooting events, indicating conditional public attention. Contrastingly, public attention to the EMS system has been stagnant or declining over the same time period. All mentions of gun violence-related keywords in presidential speeches have occurred in the past thirty years, exclusively by Democratic administrations. The onesided presidential rhetoric suggests strict partisan divides on the gun violence epidemic, which is indicated as a pillar of both parties' platforms.

Emergency services are compensating for the lack of legislative assistance through the development of HBVIPs. PIVOT, Project Ujima, and Caught in the Crossfire all mention terms related to gun violence, indicating that it is a motivation behind these programs. Contrastingly, the term related to the EMS returned minimal results across all programs. The formation of HBVIPs illustrates the evolving role of the EMS in violent crime. EMS professionals and healthcare workers are no longer solely responsible for emergency treatment, but for active prevention and tactical intervention.

The number of traffic crashes in the 1950s managed to instigate federal action to formally develop and standardize a national EMS system. The number of automobile deaths during the 1950s rose from approximately 33,000 deaths to over 37,000. In comparison, firearmrelated fatalities from 2008-2017 have surpassed the number of automobile deaths that prompted a declaration of a national "public health problem" in the 1960s that resulted in the modern EMS system⁸. The magnitude of firearm-related fatalities suggests a need for intervention in order to prevent the exacerbation of the gun violence epidemic.

The number of EMS professionals normalized by state population illustrates their nationwide distribution. States with existing assault weapons bans-NY, MA, CT, CA, HI, MD. NJ-are on the lower end of the firearm-fatalities spectrum. This suggests legislative efficacy in reducing the prevalence of gun violence and elevating levels of public safety.

Conclusion

The gun violence epidemic is a highly-politicized hallmark of the twenty-first century due to the prevalence of high-profile shooting incidents. The most notorious weapons contributing to this epidemic-assault weapons-originated during WWII and subsequently proliferated within the civilian population of the U.S., feeding the gun culture synonymous with 'Americans.' This burgeoning public health crisis shows few signs of abatement and affects countless social groups in unique ways. In order to engage in productive discourse on this issue and work toward a viable, nationwide solution that prioritizes public safety without infringing on Constitutional rights, it is critical to consider the effects of assault weaponry on overlooked social groups, such as EMS personnel. EMS roles and responsibilities have evolved due to the integration of assault weapons into civilian communities, resulting in the militarization of the EMS system. These changes demonstrate how assault weapons have functioned as a determinant technology for the EMS system and how the rights and duties of EMS personnel have evolved due to their presence within our society. Using these evaluative frameworks to analyze sociotechnical relationships can contextualize the role of technology in society and allow citizens to make informed decisions on societal issues. Understanding the scope of societal impact is the responsibility of citizens and politicians nationwide and is the first step towards a future free of mass shootings and small-scale gun violence episodes.