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MEASURING THE IMPACT OF GUN VIOLENCE ON SOUTH CAROLINA
EMERGENCY DEPARTMENTS

BY

ROXANNE RENEE JOHNSON

A doctoral project submitted to the faculty of the Medical University of
South Carolina in partial fulfillment of the requirements for the degree
Doctor of Health Administration in the College of Health Professions

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Abstract of Doctoral Project Presented to the Executive Doctoral Program in Health
Administration & Leadership
Medical University of South Carolina
In Partial Fulfillment of the Requirements for the
Degree of Doctor of Health Administration

MEASURING THE IMPACT OF GUN VIOLENCE ON SOUTH CAROLINA
EMERGENCY DEPARTMENTS

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Gun violence is a significant problem across the United States, and the economic impact of gun violence in South Carolina is not well understood. There has been a historical policy- driven trend to limit research on gun violence. Therefore, few empirical studies have been done to examine this problem. In order to determine the impact of gun violence on the healthcare utilization and cost resulting from gunshot wounds and injuries, ICD codes for state-level billing data were used to enable an estimation of county specific cost associated with gun violence. Federal laws exist on background check requirements although, state laws vary widely. South Carolina has one of the highest rates of gun violence death rates in the United States. Descriptive statistics were used to evaluate the emergency department and inpatient visits, hospital inpatient length of stay, outpatient surgeries, and overall healthcare cost (using payments). Furthermore, the data were examined to estimate the healthcare impact of gun violence by race, age group, insurance type, and county (overall and rural vs. urban). The financial cost of caring for the victims of gun violence may not be enormous it is a burden felt most by the

hospitals (due to the large numbers of uninsured) and public insurers. The most significant number of gun related burden falls on the under 40 age group, and a large portion under 19. There is little qualitative evidence of the psychological impact of gun violence on families. Future research should examine the impact of gun violence on society and families.

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Chapter 1-Introduction

Gun violence is a significant concern across the United States. However, the impact of gun violence tends to be felt at local and state levels. The economic impact of gun violence on both the state and county level in the state of South Carolina is not well understood.

There has been a historical policy-driven trend to limit research on gun violence therefore, few empirical studies have been done to examine this problem. Due to the human and financial impact of gun violence more research is required to estimate the human and the financial impact on the healthcare system.

In order to elucidate the impact of gun violence on the healthcare system in the state of South Carolina, a cohort of 2016 healthcare billing data was used to examine the financial impact of gun violence on South Carolina's citizens and economy. Specifically evaluating the burden of healthcare utilization and cost resulting from gunshot wounds and injuries using ICD codes for state-level billing data will enable an estimation of the geographic impact of the cost of caring for such wounds and the variation between counties. Emergency department visits and hospital admissions were used to determine the rate of gun violence in each county in South Carolina. County gun violence data from states similar to South Carolina were compared, and rates were combined with publically available data on gun deaths to examine the proportion of gun violence victims who come in contact with the healthcare system.

Chapter II Literature Review

Gun Violence

This literature review provides an overview of multiple types of gun violence that occur in all types of settings, including suicides, assaults, homicides and mass shootings. I completed multiple searches on topics such as gun violence, firearm injury cost, gun violence cost, private gun sales, gun control, and state gun laws. I searched for articles that were previously cited to include in my literature review. I also included articles that were from government sites such as the Center for Disease Control, The National Academy of Sciences, and the White House Now is the Time Report. One main criterion that I used was to try to include literature that was written no later than the last 10 years. According to Cukier (2018), international data supports the belief that if firearms are present, there is a greater likelihood of deadly gun violence occurring. She notes that the availability of firearms increases death rates in attempted suicides. She also suggests that individuals who display antisocial behaviors are more likely to have an accumulation of firearms.

Homicides

The Small Arms Survey approximates that annually roughly 214,000 deaths globally are related to firearm violence. Cukier (2018) adds that most of the gun incidents occurred in countries that are not involved in a war. It was determined from the Small

Arms Survey (a directive to look at small arms weapons as well as gun violence) that most of the instances of firearm violence are not fatal. In “Gun Violence” (2018) Cukier, reported that for each homicide, there are an estimated less than 7 cases of gunshot injuries not resulting in death in the United States that are treated in the emergency room. These estimates do not account for the unknown number of threats of violence and both the physical and mental impacts of such threats on individuals. Some believe that having a gun in the home may decrease crimes. However, Siegel (2013) observed a definite increase in the number of homicides when guns were available to perpetrators of crimes. Furthermore, Siegel (2017) noted that states with the most significant rates of firearm ownership were the states with the greatest number of firearms-related deaths.

Suicides

According to Anestis et al. (2015), suicide was the tenth leading cause of death in America and in a considerable number of suicide deaths firearms were often used rather than other devices or types of self-inflicted violence. “Reducing Firearm Violence: A Research Agenda” found that of all of the world, America has the greatest amount of firearm violence in any industrialized country. The NAS found that the use of firearms occurred in about 67% of murders, 42% of robberies, and 19 % of assaults.

Gani (2017), found that suicide attempts accounted for 24.9 percent of fatalities that transpired during inpatient stays or during the emergency department visit related to firearm injuries. Wintemute (2008; Wintemute, Tragedy's Legacy, 2013; Weiner, 2007;

Weiner, 2007), explains that firearm violence is an unintentional outcome from gun ownership. The researcher also reported that there is an increased probability of a violence related death. The risk intensifies when the gun is obtained, and the risk for suicide is highest amongst those that have purchased handguns during the first year of ownership or the last years of ownership.

According to Cuellar (Cuellar, 2009), self-inflicted firearm injuries resulted in an increased probability of death in the Emergency Department (19.7 percent) in contrast to deaths by assault (4.0 percent) furthermore there was a (3.8 percent) death rate for unintentional gun injuries. Emergency Department visits for accidental injuries (62.5 percent) were treated and released from the Emergency Department and (53.8 percent) were admitted to the hospital if they were the victim of an assault. The author reports that generally 5.3 percent of Emergency Room visits for gun injuries resulted in death in the emergency department and 43.5 percent resulted in hospital admissions.

Anestis (2015) asserts that limiting access to guns may decrease the risk of using firearms as a means to commit suicide. The *Department of Defense Quarterly Suicide Report* which looks at suicides of United States military service members proposes that decreasing access to a means to commit suicide may decrease incidents of suicide. The Department of Defense (2018) report suggests ways to decrease the risk for suicide. Suggestions include removing firearms or storing away from the individual's home,

storing them in a locked location (until suicide ideations have ceased) and ensuring that all firearms are unloaded when stored.

Mass Shootings

According to Brent (2014) mass shootings are only a small percentage of gun-related deaths. Campion (2017) notes that mass shootings occur in various locations including churches, schools, concerts, nightclubs and other locations, and such shootings have become a part of life in America. The Las Vegas shooting was a larger mass killing than any previously experienced in America. In that shooting, the gunman had the potential to kill thousands of people with the firearms and ammunition he had armed himself with and his position above the concert venue. The shooter used a semiautomatic gun to strike down many helpless individuals. This one incident required the support of health professionals from many different fields. Treatment from doctors, nurses, surgical staff and the coroner's office, were required to address the immediate needs of the victims after such a horrific incident. This incident is an example of the type of burden upon the healthcare industry and public health overall if these kinds of gun violence episodes occur.

Although there are many forms of gun violence, many people believe that mass shootings are the number one form of gun violence. According to Wintmute (2013), this is a misconception: mass shootings are unpredictable, and in fact, they are not the leading cause of gun-related injuries or death. In the year of 2011, approximately 88 deaths per

day occurred in the United States related to some form of gun violence. Furthermore, there were approximately 202 severe injuries each day related to gun violence (Wintemute, Tragedy's Legacy, 2013).

Gun Purchase Waiting Periods

Luca (2017) explains that having waiting periods helps reduce firearm violence by creating a cooling off period. He determined that this time allows for a substantial decrease in the number of gun incidences of gun violence. Luca determined that a waiting period may result in as much as an estimated 17% reduction in homicides. Luca reported an association between a decrease in homicide rates and waiting periods. In addition to the 17% reduction in the homicide rate, another benefit was a decrease in the number of suicides that occurred. Luca (2017) observed a 6% reduction in the number of suicides during the time frame that the Brady Violence Prevention Act was in place. Some states had background check policies in place prior to the enactment of The Brady Act. The Brady Act allowed for up to 5 days for law enforcement groups to perform background checks. The background checks were performed through the National Instant Criminal Background Check System (NICS). When the Brady Act concluded, many states had allowed their state level background check programs to expire since they had federal background check policies in place. After the National Instant Criminal Background Check System (NICS) abolished waiting periods for background checks, many states followed suit. The ability to restrict access to firearms through background checks is a

provocative subject since some gun owners worry that changes to the background check system may decrease their ability to purchase firearms. Although there have been increased penalties in some jurisdictions for using firearms illegally, there is limited research on the outcomes from such penalties.

Contributing Factors to Gun Violence

Limited Policies on Background Checks

Cook (2015, p. 28) notes that the gun industry has been monitored federally since 1968 with the implementation of the Gun Control Act. This act required those in the gun industry involved in gun sales and importing guns to have a federal license. The federal gun regulations require that consumers show identification to purchase a firearm. Purchasers must also complete a 4473 form that affirms they are able to legally purchase a firearm and have no felony convictions that would prohibit the purchase of a firearm. The background checks are completed by the gun dealer. The check evaluates individuals at both state and federal levels to ensure that those who have been disqualified from purchasing a gun are not allowed to complete the purchase of a firearm.

It is believed that a waiting period may decrease gun violence related to impulsivity. As Luca (2017) indicated, the Brady Handgun Violence Prevention Act was a leading factor in the decrease of firearm violence from approximately 1990-1998. During that time frame, federal regulations restricted the purchase of firearms by

requiring several states to perform background checks on those attempting to purchase firearms from licensed gun dealers. A National Academies report, *Priorities for Research to Reduce Firearm Related Violence* (2013) suggested that the illegal possession of firearms is associated with an increased incidence of gun violence.

Private Party Gun Sales

Cook (2015) explained that private party gun sales do not require the same rigorous level of background checks as other sales. Private gun sales may go through a gun dealer or through private parties. Sales that occur through private sales and do not involve a gun dealer are not federally monitored. Sales that are completed using a licensed gun dealer must abide by the federal regulations for used gun sales. One major caveat for out of state gun sales is that guns may not be shipped to a purchaser unless that purchaser maintains a retail license to purchase guns.

Cook (2015) reported that there are 17 states that require some form of gun regulation during private transfers of gun ownership. These states require tougher rules than the federal regulation of private party transfers. For example, Illinois necessitates that any source involved in gun transfers must possess a Firearm Owners Identification.

National and state laws are in place regarding gun ownership. Some state policies overlap national gun policies. The background check system in the United States is the National Instant Criminal Background Check System (NICS).

Congress reviewed gun background check policy after the Newtown Connecticut shooting (Barry, McGintly, Vernick, & Webster, 2015). They reviewed legislation to improve current policy on background checks for gun sales. The legislation would include background checks on both private party gun sales and internet gun sales. After Newtown a major shift in gun laws has yet to occur. According to Barry, prior studies noted that lengthening pre-background checks for those attempting to complete private party sales may avert the diversion of guns into the hands of criminals, thus reducing the number of homicides.

Barry et al. (2015) report that many citizens, as well as approximately 84% of firearm owners, embrace background checks for all firearm sales. Months after the Newtown shootings Senators Manchin and Toomey supported legislation that would have required background checks on all gun sales. Unfortunately, the bill failed to pass by six votes in the Senate, the purposed federal legislation influenced some states' firearm policies. The bill toughened background checks in New York, but, Alabama and Georgia permitted guns to be carried in public places with fewer restrictions Barry et al. (2015).

Tracking Gun Ownership

According to the Institute of Medicine and National Research Council (2013), rudimentary statistics about gun ownership, storage, and firearm procurement are lacking. Furthermore, in the United States, exactly who owns a gun or how many they own are unknown. Knowledge on gun ownership is processed through the Bureau of Alcohol,

Tobacco, Firearms, and Explosives (ATF). However, this agency has a limited ability to follow the path that a gun travels when exchanging hands legally and illegally.

Gun Carrying

Cook (2015) reports that 17 states have some background check system.

One potential contributing factor to the rate of firearm injury may be the fact that many gun owners are carrying loaded guns. Rowhani-Rahbar (2017) indicated that approximately 3 million individuals carry a loaded handgun daily, and that 9 million adults in the United States are carrying loaded handguns on a daily basis. Rowhani-Rahbar (2017) also notes that those that carry concealed weapons are often in states that have less restrictive gun laws.

Automatic /Semiautomatic Weapons

Automatic weapons have become problematic for many in the law enforcement field. These highly powerful weapons are on the street or available for purchase in most towns in America to those seeking weapons. One of the recommendations of the *Now Is The Time report* (2013) was to ban military-style assault weapons. The ban did not occur under the previous administrations and is unlikely to occur under the current White House administration tenure since the National Rifle Association supports much of the current administrations' stance on gun policy.

A semi-automatic weapon was used to commit the shootings in Newtown Connecticut that resulted in the killing of 20 children and 6 adults. A Bushmaster XM15-E2S (which is a semi-automatic version of the AR15 rifle) semi-automatic weapon was used in the Newtown shooting. Thus, there has been discussion regarding the possibility of reinstating the implementation of the Federal assault weapons ban. Gius (2014) noted that the Violent Crime Control and Law Enforcement Act of 1994 banned the use of semi-automatic weapons. The act also outlawed the use of high capacity magazines with greater than 10 rounds of ammunition. The Federal ban ended in 2004, which caused many states to develop their own bans of semi-automatic weapons.

Limited Gun Research

The National Research Council (2013), has argued that there are inadequacies in the research and the CDC has identified an essential need for both state and federal agencies to collaborate. Such alliances can help advance the research on firearm injury and deaths. Currently, the data on gun violence is derived from datasets that were acquired for other purposes. The sources may include healthcare, crime, or more expansive forms of research data.

State Gun Laws

Although national firearm laws exist, the development of firearm legislation at a state level may be the quickest and most effective route to decrease the number of mortalities related to firearm violence. It is hypothesized that formulating persuasive, effectual, unthreatening communication about gun violence at state and local levels can realign dialogues concerning firearms (Branas, 2017).

Some states have succeeded in developing new firearm initiatives and passing gun laws. Branas (2017) acknowledges that three out of four states addressing gun control on the ballot in 2016 passed. Outcomes such as this solidify the benefits of addressing gun laws at both state and local levels. Devising gun laws at state and local levels may help to promote addressing federal gun legislation in a more tolerant political atmosphere.

Massachusetts is one state that requires both licensed and unlicensed sales to maintain records of gun purchases. Obtaining such data enables authorities to trace firearms and decrease illegal second-hand gun sales (Braga, 2015). Moreover, there is a lack of information in the Massachusetts gun sales computer tracking system. He suggests that there has been a deficiency in the assets used for the gun regulation, enforcement, and tracking of gun sales and laws (Braga, 2015).

To help gather information on gun possession and illegal sales, a survey was administered to inmates of the Cook County jail system. The surveys included questions pertaining to the purchase of firearms. The surveys involved in-person interviews and were transcribed and recorded. Survey participants noted that guns may be obtained by the following means: individuals who had a FOID Card purchased firearms for those who

did not; in-state gun buyers often purchased guns for others, even making purchases for gang members at times; some guns may have been obtained from the police placing illegal guns back on the streets.

Private Party Gun Sales

Although background checks are completed when purchasing a firearm from a legal merchant, that safeguard is not used when purchasing a firearm during private party sales. This form of firearm sale allows people who may not be eligible to purchase a gun from a reputable merchant to purchase a gun without requiring a background check. Braga (2015) observed that secondary gun sales are a primary source of firearms used by criminals.

Open Carry and Concealed Weapons

According to Siegel et al. (2017), in 2015 all states in the United States allowed some form of conceal carry laws. In some states, law enforcement was able to help to determine if a concealed weapon permit should be issued. Siegel et al. (2017), referenced these states as “may-issue” states. Furthermore, they reported 32 states were considering “shall issue” statutes. Those states are obligated to issue concealed weapon permits to those that meet all conditions under the law in their states. Other states required no concealed weapon permit.

Siegel et al. (2017), implied that there is a strong link relating shall issue gun laws and a greater rate of homicide. Additionally, the researcher indicated that the lean towards lax concealed-carry laws may be contradictory to public opinion. Public opinion supports more gun control regarding open carry laws. Moreover, the law is conflicts with the advancement of public safety regarding gun control.

The ability to easily access firearms may increase the risk of firearm violence. Siegel et al. (2017) acknowledges that one barrier to conceal carry laws is limited information concerning the use of long guns in comparison to handguns to commit murder. The researcher argued that conceal and carry laws may increase the murder rate and if so, there should only be increased homicide rates with short guns, not long guns. He reports that some people believe a more laissez-faire conceal carry weapon laws discourage crime related to apprehension among criminals fearing that potential crime targets may be armed. On the other side of the debate is that increased numbers of people carrying guns may result in increased firearm related mortalities.

Siegel explained that calculating data from both linear models and counts suggest that shall issue concealed carry laws are linked to a 6.5 percent higher total homicide rate and an 8.6 percent greater gun-related murder rate, as well as a 10.6 percent greater risk of murders committed exclusively with handguns in contrast to states that have may issue gun laws (Siegel M. , 2017).

According to Gani (2017), the greatest number of patients who were brought to the emergency room alive related to firearm injury were injured by handguns (27.0

percent) compared to shotguns (5.9 percent) and hunting rifles (2.0 percent). The rate of shotguns and hunting rifles trailed handguns' injury significantly.

The National Rifle Association's Hold on the Gun Industry

Many United States citizens support some form of gun control although the politics around gun legislation may contribute to the difficulty of changing current firearm policies. During the 1990s, funding of gun violence research ended. The National Rifle Association was displeased with the fact that research funded by the CDC showed a link between having guns in a home and higher homicide rates. Therefore, the NRA lobbied Congress to terminate all CDC gun-related research. According to Hills-Evans (2018), in 1996 Congressman Jay Dickey incorporated in the appropriations bill that no CDC funding could be used for firearm injury prevention and control and furthermore, it could not be used to support gun control.

In the past, the National Rifle Association (NRA) had much control over the gun industry and gun legislation. Wintemute (2013) reveals that in recent years the NRA did not have the political dominance it once had to influence election outcomes. He also reports that according to the Sunlight Foundation that under 5% of the National Rifle Association's campaign payments in 2012 yielded the desired political results. However, the election of President Donald Trump may have changed the trajectory of the discussion of the effectiveness of the efforts of the gun lobby in political elections. According to Branas (2017) Donald Trump is an advocate of gun rights. In an effort to

promote a future president that would support their agenda the gun lobby backed Donald Trump's political campaign with more than 30 million dollars.

Common Sense Gun Laws

Common sense gun laws may be the answer to deterring gun violence in the United States. Siegel et al. (2017), explains that gun related violence is a serious health problem. He points out that there is an ongoing discussion regarding policies that may reduce firearm violence. One question is whether reducing the ability to conceal firearms helps reduce or increase deaths related to the use of firearms. However, the mere presence or fear of firearms may dissuade violent crimes. Siegel et al. (2017), also reported that the increased number of people carrying guns may result in amplified cases of death related to gun violence. Lastly, the researcher suggested that having a comprehensible knowledge of the influence of the conceal- carry laws could help steer policymakers seeking to reduce gun violence.

Availability of Firearms

According to Brent et al. (2014), there are statistics that link suicide and the availability of firearms. However, there is a lack of research on the correlations connecting gun death rates to suicide. There is no known data on exactly how many firearms are owned in America. According to the National Academies (2007), there are approximately 294 million firearms. Of those, there are 83 million shotguns, 105 million rifles, and 106 million handguns. These estimates indicate that there are more firearms in

America than in any other nation. Moreover, the National Academies (2013) noted that most gun owners own more than one firearm.

The National Academies reported that youth in rural areas are more likely to own firearms. In fact, approximately half of the youth in rural areas are gun owners. Furthermore, an estimated 80 percent of rural male's report that they own guns (2007).

Public Health Approaches to Gun Violence

Since the public health community addresses topics that are correlated with mortality and morbidity many in the field of public health believe that gun violence should be addressed. Fowler (2015) mentions that approximately 645 people a week die related to firearm injuries and another 1,565 are cared for in an emergency room for related injuries. The incidence and complications associated with gun related violence and wellbeing and safety of the population make gun violence an area of public health concern. According to the Institute of Medicine of the National Academies (2013), a committee was formulated and tasked with developing a future research program that could deliver outcomes in 3-5 years. They are concentrating on risk, possible interventions, safe gun technology, and the impact of media and gaming to decrease the burden of gun violence.

Gun Violence as a Public Health Crisis

Public Health Approaches to Gun Violence

Gun violence is a public health problem, and Venrick (2002) explains that public health experts can develop strategies to enhance instruction methods to educate others related to gun regulations. He comments that public health specialists can collaborate with public health attorneys to structure unimpeded ways to address gun legislation. Using the approach of addressing gun violence as a public health issue allows experts to ask questions such as those developed by Vernick (2002) “How can I use the law to create new interventions, or improve existing ones, to protect the public health?” and “Will the law prevent me from successfully implementing certain interventions (Vernick, 2002, p. 9)?” Asking questions like these may help to further develop opportune legal resolutions to firearm violence.

According to a Preventive Medicine Journal Editorial (Preventive Medicine Journal, 2015), the shocking data on gun violence and suicide caused the multiple authors to collaborate on a special issue of Preventative Medicine to discuss the epidemiology and forms of prevention of firearm violence. Webster and Hemingway (2015) contended that there is limited financial support for research on gun related injury and prevention. Given the size of the problem, research funding concerning disability, injury, and deaths associated with firearm injury is distressingly low.

The Institute of Medicine and National Research Council (2013) assert that concentrating on gun violence as a public health issue may be completed using three components: prevention, scientific methods of identification of risk factors, trends and multidisciplinary. Other issues of public health concern in the past have been addressed

and reduced. Examples include the use of tobacco, motor vehicle, deaths and unintentional poisoning.

A 2013 Institute of Medicine and National Research Council (2015) report highlighted the acute need for future research on prevention of gun related injuries. The Institute of Medicine and the National Research Council (2013, p. P12:Para2) explained that to decrease deaths related to gun violence President Obama mandated 23 executive orders charging federal agencies with the task of gaining more comprehension in regards to gun violence, prevention of gun violence and approaches to reduce firearm violence as a public health issue.

Fowler (2015) argued that gun violence is preventable, and recommended finding the root problems leading to gun related injuries determining the causes by looking at the who, what, when and where. Then she suggests studying risk factors associated with gun violence such as geographic and demographic predispositions, and if the violence was self-inflicted or directed toward others just to name a few starting points when reviewing firearm violence.

Gun Violence Disparities

Gun violence is more common in urban areas; they have greater numbers of homicides correlated with firearms. Males are more often both the victims of gun violence and the perpetrator of gun related deaths. In instances where there was a

relationship between the victim and the offender, they are both often of the same race (The National Academy of Sciences, 2007).

Communities have an impact on gun violence. According to the National Academy of Sciences (2007), the greatest number of those affected by firearm violence in communities are minorities. Scarcity of economic opportunities, large numbers of disadvantaged citizens, and neighborhoods that lack social organization are contributing factors to youth violence.

Individual factors that impact gun violence include poor education, past history of violence, drug and alcohol abuse, and isolation. The National Academies of Science (2007) notes that youth carry firearms because they have been victims or believe that they are vulnerable. The Academies of Science report that gun violence accounted for 84% of homicides in youths aged 10-19 (2007).

Suicide

According to Anestis et al. (2015), suicide was the tenth leading cause of death in America and it is likely that the considerable number of suicide deaths are related to the fact that firearms are often used in self-inflicted violence. Anestis (2015) asserts that limiting access to guns may decrease the risk of using firearms as a means to commit suicide. Weiner (2007) found that of all of the world, America has the greatest number of firearm violence in any industrialized democratic country. The NAS found that the use of firearms occurred in about 67% of murders, 42% of robberies, and 19 % of assaults.

Gani (2017), reported that that deaths rates related to suicide attempts accounted for 24.9 percent of fatalities during the emergency department visit, or inpatient stay of those patients admitted for gun related injury. Wintemute (2008; Wintemute, Tragedy's Legacy, 2013; Weiner, 2007; Weiner, 2007), writes that firearm violence is an unintentional outcome from gun ownership. He reports that gun ownership increases the probability of a violence-related death.

Gun Research

Unfortunately, not much has changed in the area of gun violence research in decades due in part to the limitations on gun violence research. The National Academy of Science (NAS) found that insufficient data and restrictions in data are obstacles in learning as much as possible about gun violence. One recommendation from the NAS is that there are still avenues of access to gun violence data that are not being applied (Weiner, 2007, p. p1:p81).

Branas (2017), indicates that there is a deficiency in the research that is available in comparison to the actual number of firearm injuries. His opinion is there is a link that connects firearm ownership and increased risks for gun violence such as homicides. He goes even further to indicate that the use of data from the Center for Disease Control (CDC) was believed to favor gun control. According to Branas (2017) future research may need to come from the public health academic population. He believes that academia may be able to produce funding in the form of scholarships to address the lack of discussion at a national level and develop “evidence based” research on firearm violence.

He concludes that perhaps private funding may be a way to accelerate the conversation on how to accomplish more gun research. Branas (2017; Brent, 2014), argues that the public health academic community is the best resource to locate the funding of firearm research. Notwithstanding the momentous firearm related injuries, and mortalities as well as the economic expense affiliated with gun injuries, there is limited data available to evaluate the true impact of gun violence. The statistics that are available are frequently obtained from “single-center studies performed at tertiary referral centers and Level I trauma centers, or report on state-specific clinical and financial outcomes among patients injured in firearm related violence (Gani, 2017, p. 4 para.2)”. According to the Federal Bureau of Investigation (FBI), approximately 30,000 deaths occurred related to gun violence in 2003 (Reducing firearm violence: a research agenda, 2007).

Proposed Steps to Decrease the Incidence of Gun Violence

Firearm Prevention Education

Education of the public on the dangers of firearms and simple steps that may decrease the likelihood of firearm injuries. Development and promotion of a nationwide education program for the general population on the increased dangers of having a gun in a household are needed to educate the public. Nationwide education programs have worked in the past using massive advertising campaigns when public health issues were a stake. Firearm education should become a national priority to decrease the number of lives lost to gun violence.

Developing a Public Health Approach to Gun Violence

Branas (2017) recommends the development of a group of stakeholders, including police, gun manufacturers, gun advocates, suicide prevention specialists, gun safety advocates, and those from the public health arena. This group would develop ideas and proposals on how to alleviate some of the consequences associated with firearm ownership by everyday citizens. Branas (2017) states that a more extensive view of decreasing gun violence as a daunting health issue instead of concentrating on the guns may be a more amenable course of action.

The Financial Burden of Gun Violence

Financial Impact of Gun Violence on the Nation

Braga (2015) points out that both work loss and medical costs of gunshot injuries are considerable. Deaths related to gunshot wounds were found to cost more than \$48 billion dollars from 2010-2012. According to Braga, an estimated 91% of the costs were associated with fatal gun injuries. The estimated work loss cost included those that were hospitalized, were treated and discharged, and those that died related to firearm injuries.

Jacobs and Warshaw (2014) noted that the financial burden of gun violence is almost solely funded by Medicare and Medicaid. Therefore, it is a burden on the federal government to cover the exorbitant cost of gun violence. Lee et al. (p. 896, para 3) go even further and determine an estimated cost of gun violence of \$86 billion dollars from 2006 to 2010 (Lee J. , 2014).

According to Miller (2012) a Pacific Institute Researcher (PIRE), the cost of injuries related to firearms in the United States was \$174 billion in 2010. His research concluded that the cost of gun violence equals to approximately \$645 per gun.

A report, issued by the National Academy of Sciences (2007) investigated the correlation between violence and guns. This study revealed that the worldwide number of gun-related deaths was approximately 196,000-229,000.

The financial cost of gun violence is an issue that must be addressed. Wintemute (2008) points out that the approximately 70,000 people were treated for firearm injuries in emergency rooms in America. This number only accounts for those that suffered from gun related injuries that were not fatal. He states that the seriousness of most gun injuries results in fatalities. Wintemute (2008) also reports that the cost of firearm injury resulted in \$2 billion annually healthcare expenditure to cover the cost of healthcare for those injured by firearms. The burden of firearm injuries and the resources required to care for these type of injuries are imperceptible. It is estimated that these firearm injuries cost are approximately \$100 billion dollars.

Jarone (2014) observed that those affected by gun violence often lack health insurance coverage. He reported that an estimated 75 percent of patients are underinsured and may only possess Medicaid or Medicare as their primary health coverage.

The cost of gun violence on the families of those impacted by gun violence is immeasurable. As we turn on our televisions to both nightly world and local news, often

the storylines are that someone has been shot and killed or wounded. We as a nation need to decide what can be done to stop this trajectory of gun violence.

The Impact of Gun Violence in the State of South Carolina

Gun laws in the State of South Carolina

The South Carolina code of laws addresses the issue of found handguns by requiring that found guns be turned over to local law enforcement and found guns are possessed for 90 days by local law agencies. During the 90 days, if the owner is unknown, then a valiant attempt is made to locate the lawful owner of found handguns. According to the South Carolina Code of Laws, if no rightful owner of a handgun is located, handguns may be turned over to the individual who found the firearm after they fulfill the application process. South Carolina law prohibits machine guns, sawed-off shotguns, and any form of military firearm. Compared to some states South Carolina has a high firearm ownership rate.

South Carolina Homicide and Suicide Rates Per County

According to the South Carolina Department of Health and Environmental Control South Carolina ranked 7th in 2014 the United States with 364 homicides in 2014. According to Knapp (2017), there were 16 deaths weekly, with 841 deaths from gun violence in 2015 in South Carolina. Since that time, gun violence has increased in the Midlands, the Grand Strand, and the Low country. From January 2017 to July 2017 the homicide rate by gun violence in Charleston was 35, including 20 in North Charleston

(Knapp, 2017). The 2016 firearm mortality rate in South Carolina was 17.7 people per 100,000, much higher than the overall US rate of 11.8 per 100,000 (Figure 1.) (CDC <https://www.cdc.gov/nchs/pressroom/states/southcarolina/southcarolina.htm>).

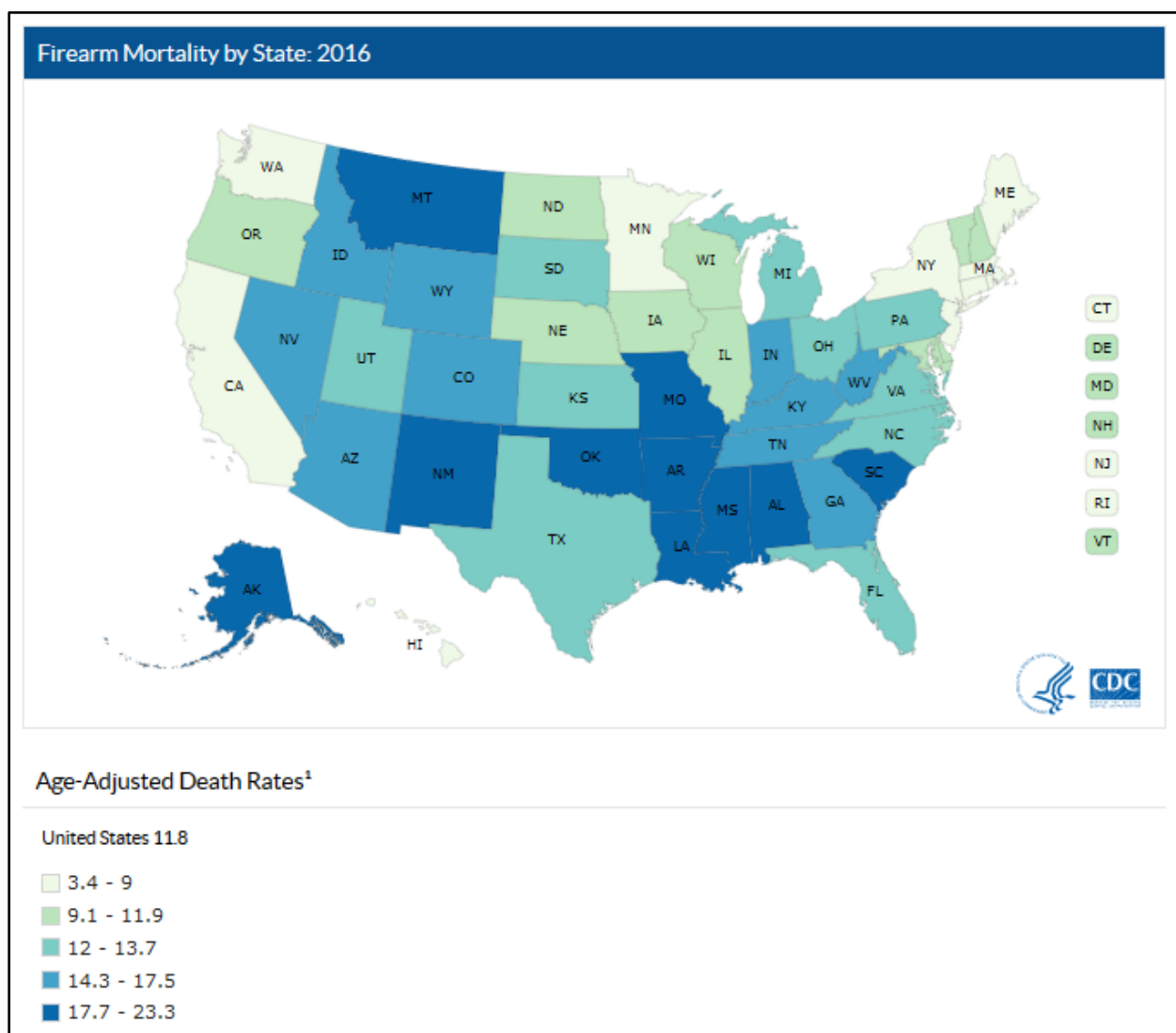


Figure 1. 2016 US Age-adjusted Firearm Deaths per 100,000 Population (CDC).

For comparison, the 2013-2015 age-adjusted firearm homicide rates by SC County are included in Figure 2.

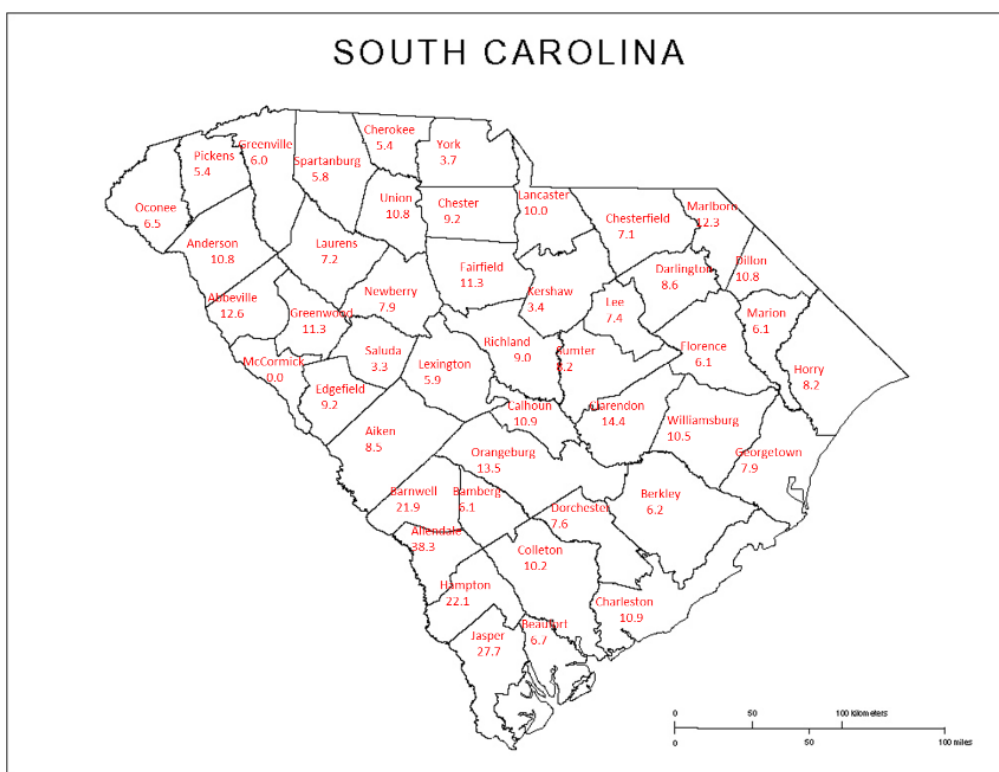


Figure 2. SC County Level 2013-2015 Age-adjusted Homicide Rates by Firearm per 100,000 Population (DHEC).

South Carolina also has a high number of suicides. The 2016 suicide Rate in South Carolina was 15.7 people per 100,000 according to the Center for Disease Control (CDC <https://www.cdc.gov/nchs/pressroom/states/southcarolina/southcarolina.htm>). The 2013-2015 age-adjusted firearm suicide rates by SC County are included in Figure 3.

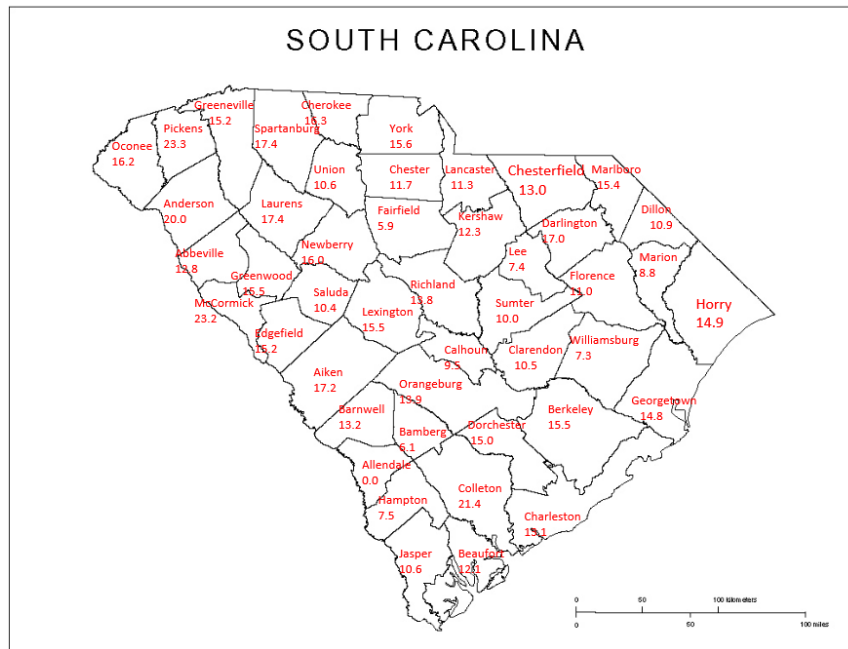


Figure 3. SC County Level 2013-2015 Age-adjusted Suicide Rates by Firearm per 100,000 Population (DHEC).

According to Howard (2017), an estimated 267,256 U.S. patients were admitted for firearm-related injuries from 2006-2014, and the cost of initial hospitalizations for their injuries were approximately \$734.6 million dollars a year (p.3). The data in this study was used to review hospital cost for injuries related to guns shot wound and not the cost of extended care such as re-hospitalizations or rehabilitation. Little is known about the impact of firearm violence on the healthcare system of South Carolina.

Conclusion

As a result of analyzing the current data and literature, it was determined that further research is needed on the topic of gun violence and the medical cost of caring for

gunshot wounds. There is very little data to reveal the exact economic burden placed on communities, hospital systems, and insurance companies related to caring for the victims of gunshot wounds.

Chapter III Methods

South Carolina is one of the US states with the highest rates of gun mortality per population. However, little research has occurred to examine the impact of this violence on the healthcare system of the state and for each county.

Study Aim

Describe the impact of gun violence, overall and by county, on healthcare facilities in South Carolina in 2016.

Study Design

This is a descriptive cohort study, examining the impact of firearm violence on the healthcare system in SC.

Data Source

The 2016 Healthcare Cost and Utilization Project (HCUP) State Specific Emergency Department Data (SEDD) was used to determine the impact of violence on the healthcare systems in the state of South Carolina. Data collection will come from emergency room data related to firearm injuries. Sources such as the Center for Disease Control (CDC) for underlying population numbers and HCUP Data will be used to research the number and cost of emergency room and hospital visits for firearm injury.

Measurement of Variables

State level descriptive statistics will be performed to evaluate the overall firearm rates within the SC health system. We will examine 2016 Emergency Department (ED) admissions, hospital admission, and length of stay, and outpatient surgeries (OS) for the

state of SC as well as overall healthcare costs (using payments) for each of these. We will also describe impact by race, age group, insurance status, and by county (rural and not rural).

Cohort Identification

The firearm injury cohort will be identified by ICD-10 codes (Table 1).

Table 1. ICD-10 Codes of Gun Related Injuries (GunPolicy.org)

Code Description	ICD-10 Codes
Firearm injury: Assault (Gun Homicide, attempted or completed)	X93- Assault by Handgun discharge X94- Assault by rifle, shotgun & larger firearm discharge X95- Assault by other & unspecified firearm discharge
Firearm Injury: Self-harm (Gun Suicide, attempted or completed)	X72- Intentional self-harm by handgun discharge X73- Intentional self-harm by rifle, shotgun & larger firearm discharge X74- Intentional self-harm by other & unspecified firearm discharge
Firearm Injury: Unintentional (unintentional Shooting, fatal or non-fatal)	W32- Handgun discharge W33- Rifle, shotgun & larger firearm discharge W34- Discharge from other and unspecified firearm
Firearm Injury: Undetermined intent (Unknown cause, fatal or non-fatal)	Y22- Handgun discharge undetermined intent Y23- Rifle, shotgun & larger firearm discharge undetermined intent Y24-Other & unspecified firearm discharge undetermined intent
Firearm Injury: Justifiable shooting	Y35.0- Legal intervention involving firearm discharge
Firearm Injury: War Operations (War shootings, fatal or non-fatal)	Y36.4- War operations involving firearm discharge and other forms of conventional warfare includes bullet wounds, shotgun wounds, bayonet injuries battle wounds and battle drowning; excludes explosives, downed aircrafts, fires, nuclear weapons, landmines, biological and chemical weapons, and unspecified war operations
Firearm Injury: Terrorism (Gun Terrorism, fatal or non-fatal)	U01.4- Terrorism involving firearms (homicide, completed or attempted). A rarely used, provisional category
All-methods codes overall totals for calculating the	X85 to Y09- Assault (Homicide all- methods, attempted or completed); i.e. fatal or non-fatal

proportion of firearm homicide or suicide	X60 to X84- Intentional Self-harm (Suicide all- methods, attempted or completed)
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Statistical Analysis Methods

Descriptive statistics of the cohort population will be described as number and percentage of individuals in each category. Rate of ED visits and hospitalizations will be calculated as number per 100,000 population. County level rates will be calculated as the number of events divided by 100,000 population (as reported by census.gov). In order to estimate the proportion of gun violence victims who come in contact with the healthcare system, the number of firearm deaths that do not result in ED or hospital admission will be examined. We will subtract the study event estimates for discharged dead, from the CDC (for state-level) and DHEC (for county-level) reported events. These will be reported as percentages by multiplying by 100.

CHAPTER IV

RESULTS

Introduction

The purpose of this study was to determine the impact of gun violence on South Carolina emergency departments. SC data from the Office of Research and Sponsored Programs (ORSP) for 2016 was used to investigate the frequency and type of patients entering emergency departments in South Carolina for firearm injuries. ICD 10 firearm diagnosis codes were used to select the patient cohort. The firearm mortality rate in 2016 in South Carolina was 17.7 people per 100,000 and the national average for gun violence mortality was 11.8 (CDC). According to the Center for Disease Control, the total number of individuals who died due to firearm violence in the state of South Carolina in 2016 was 891 (CDC). This section includes tables, maps, and graphs to depict the frequency of gun violence and demographics of gun violence victims.

Individuals who presented in ED and hospitals in SC in 2016 tended to be younger, with 77.04% under the age of 40 and were predominately male (82.65%) (Table 1). Greater than two-thirds were African American and just under 41% were uninsured (Table 1). Of the 196 individuals who had a healthcare visit related to firearm violence, only 7 (3.57%) resulted in death during the ED visit or hospitalization. A majority of individuals were seen in the ED, were not admitted to the hospital, and did not require outpatient surgery (Table 1).

Table 2. Patient Characteristics of Gun Violence ED and Hospital Visits in 2016 (N=196)

	N (%)
Age Group	
≤ 19	42 (21.43)
20 – 24	34 (17.35)
25 – 29	35 (17.86)
30-39	40(20.41)
40-49	25(12.76)
50+ years	20(10.20)
Sex	
Male	162 (82.65)
Female	34 (17.35)
African American	135 (68.88)
Insurance	
Medicaid	44 (22.45)
Medicare	11 (5.61)
Other	15(7.56)
Private	46(23.47)
Uninsured	80 (40.82)
Died	7 (3.57)
Violence type	
Accident	132 (67.35)
Assault	49 (25.00)
Other/Unk/Suicide	15 (7.65)
Emergency Room Visit	
No	56 (28.57)
Yes	140 (71.43)
Inpatient Visit	
No	122 (62.24)
Yes	74 (37.76)
Outpatient Surgery Visit	
No	128 (65.31)
Yes	68 (34.69)

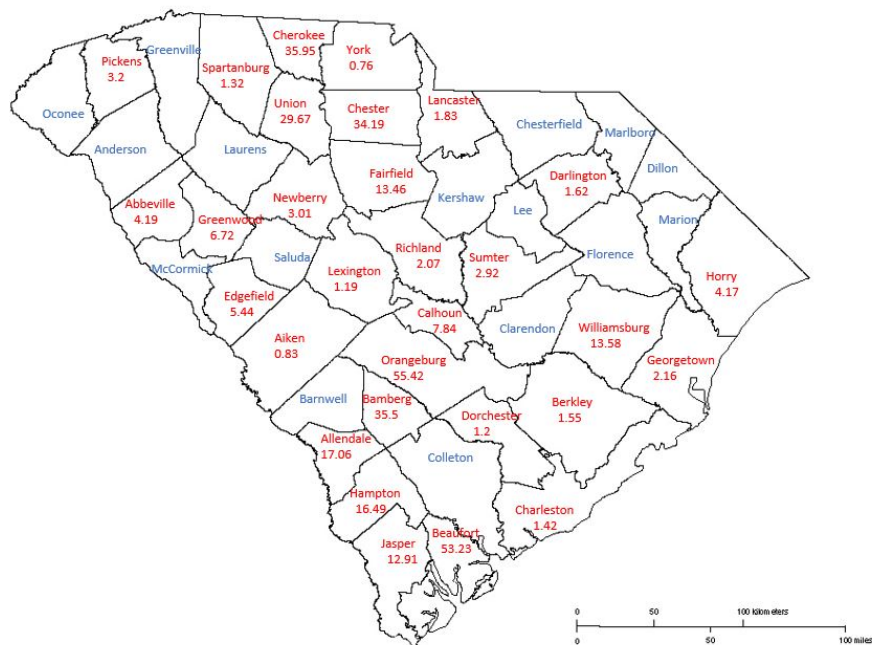


Figure 4. Map of South Carolina Gun Violence Rate per 100,000 by County

*blue counties have no gun-related healthcare visits in 2016

The highest event rates of firearm-related violence per 100,000 occurred in rural counties. The top 15 counties for gun violence episodes are in some of the most rural counties in the state. Orangeburg, Beaufort, and Cherokee counties had some of the most noteworthy high frequencies of gun violence in the state (Figure 4). Although, these counties had large numbers of gun violence victims each of these counties had a population of under 100,000 people. Furthermore, the 15 counties with the highest percentages of gun violence patients were from counties with populations under 100,000.

The average rate of gun violence was 9.385 in all rural counties including counties with 0 events.

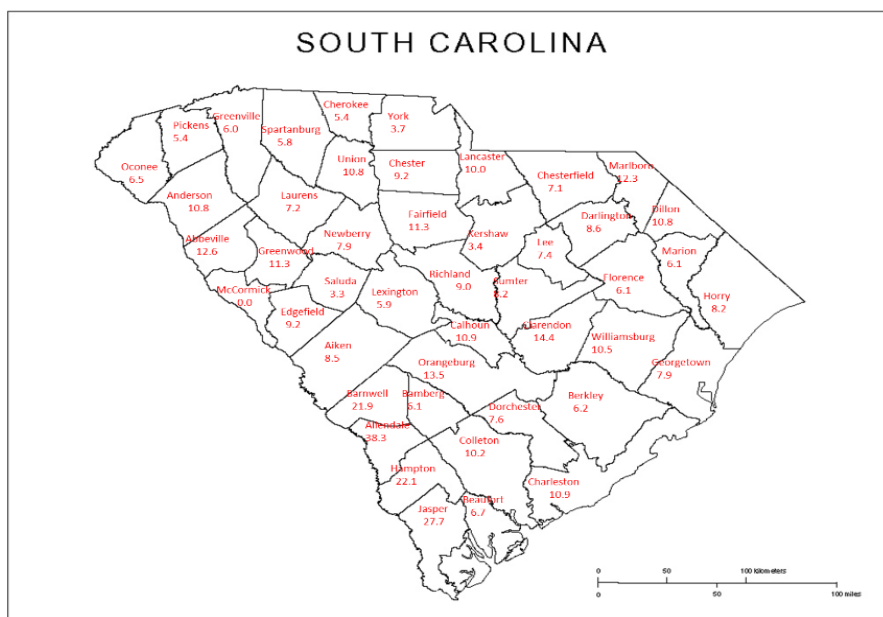


Figure 5. South Carolina Homicide Rates by County

Assaults were the second leading cause of gun violence in the state of South Carolina. The frequency of assaults in South Carolina was 49 incidents out of our sample of 196 patients. South Carolina's assault rate was 9.0 in comparison to the U. S. rate of 6.2. Assaults were categorized by ICD-10 codes (from gunpolicy.org) that used the following code descriptions for firearm injury, assault (gun homicide and includes both attempted and completed) X93 assault by handgun, X94 assault by rifle, shotguns and

more substantial firearm discharge, and X95 Assault by other & unspecified firearm discharge.

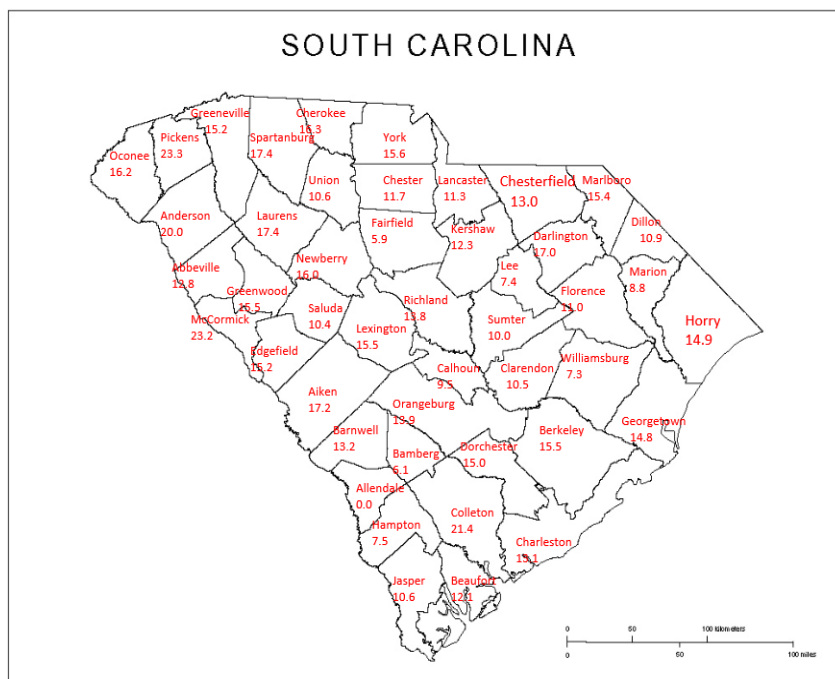


Figure 6. Map of South Carolina Suicide Rate by County

The above map shows the frequency of suicide in South Carolina by county. The suicide rate is above the US rate of 13.5. Suicides were identified using the following firearm injury and self-harm ICD-10 codes X72, X73, and X74. Suicides, other and unknown forms of gun violence. The suicide frequency was 15 (7.65%) times out of the sample of 196.

Table 3.

South Carolina Counties with the Highest Frequency of Suicide Per 100,000 2013-2015

County	Suicide Rate	Region
Pickens	23.3	Upstate
McCormick	23.2	Upstate
Colleton	21.4	Lowcountry
Anderson	20.0	Upstate
Spartanburg	17.4	Upstate
Laurens	17.4	Upstate
Aiken	17.2	Midlands
Spartanburg	17.4	Upstate
Laurens	17.4	Upstate
Cherokee	16.3	Upstate
Oconee	16.2	Upstate
Newberry	16.0	Midlands
York	15.6	Midlands
Lexington	15.5	Midlands
Greenwood	15.5	Upstate

Berkley	15.5	Lowcountry
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Table 3 Indicates that in term of a hierarchical level the upstate had the most significant loss of life from suicides followed by the Midlands and then the Lowcountry. South Carolinas data was obtained from The Department of Health and Environmental Control (DHEC) 2013-2015 addressing the death rates by county and region. DHEC identified suicides and attempted suicides using ICD 10 Codes X60-X84, as well as Y87.0 including the discharge of firearms (X72-X74), other diagnosis includes (X-60-X71, X75-X84, Y87.0). Further investigation is needed to determine if there is a correlation between suicide rates and particular state regions in South Carolina.

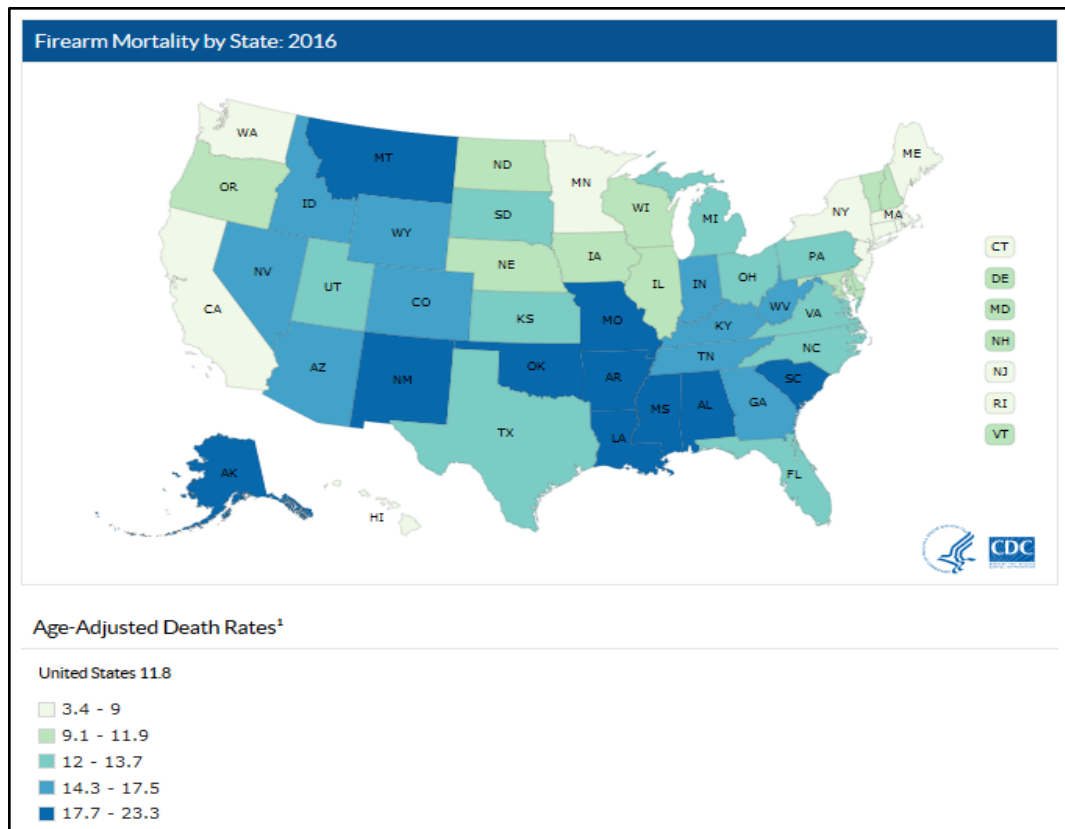


Figure 7. 2016 Firearm Mortality Rates per 100,000 by State

The U.S. firearm mortality rate in 2016 was 11.8 in comparison to South Carolina's firearm mortality rate of 17.7 people per 100,000. South Carolina's firearm mortality rate in 2016 was 891. South Carolina has a higher frequency of gun violence in comparison to our sister states of Georgia and North Carolina. According to the Center for Disease Control firearm death rate in North Carolina was 13.7 per 100,000 and a total of 1,409 firearm mortalities. Georgia had a firearm rate of 15.0 per 100,000 and total firearm mortality of 1,571. It is important to note, based on our data, that only 7 of gun-

related deaths from 2016 resulted in a healthcare visit, with the remaining 884 reported deaths that year being fatal prior to ED or hospital visits.

The African American community was most frequently affected by gun violence predominately two-thirds of the sample was African American (Table 4). 135 African Americans required some form of healthcare related to gun violence which was 68.8 % of the sample. In comparison, only 61 (31.12%) of victims from all other races required health care related to gun violence. African Americans numbered 135 out of the total sample group of 196 (Table 4).

Table 4. The Impact of Gun Violence on African Americans

Race African American	Frequency	Percent	Total Days in Hospital 2016	Total Cost of Hospital Care for all patients in 2016
No	61	31.12	90	\$289,135
Yes	135	68.8	248	\$1,077,716

Firearm injury in African Americans resulted in 248 days in the hospital and a total of over \$1,000,000 of healthcare-related costs (Table 4).

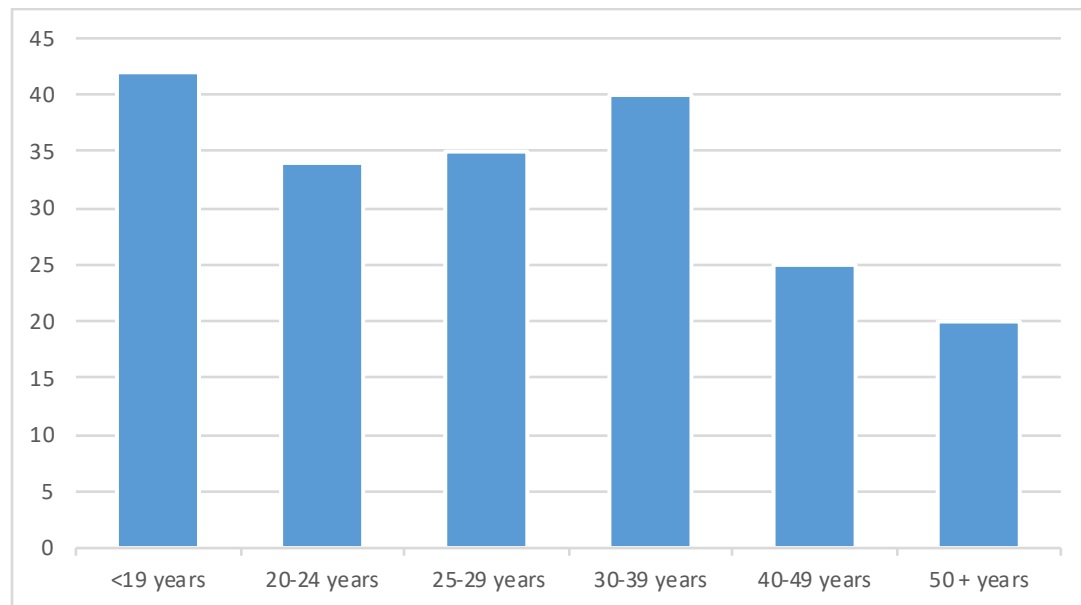


Figure 8. Number of Gun Violence Healthcare Visits by Age Group

Gun violence occurrences that resulted in healthcare visits varied greatly by age. The largest groups involved in gun violence are those under 19 and between 30-39 year-olds. These age groups accounted for 82 of the 196 cases of gun violence in the state. Visits resulting from gun violence begins to decline rapidly in the 40-49 and the 50+ age groups.

Table 5. The Burden of Firearm Injury by Age

Age Category	Frequency	Percent	Length of Stay	Cost
<19	42	21.43	51 Days	\$133,457
20-24	34	17.35	52 Days	\$269,499
25-29	35	17.86	45 Days	\$255,587

30-39	40	20.41	64 Days	\$364,880
40-49	25	12.76	75 Days	\$204,283
50+yrs	20	10.20	51 Days	\$139,145

Table 5 indicates that the under nineteen age category had the most frequent hospital encounters for firearm injuries. However, the 30 to 39 year old age group had the longest length of stay related to gun violence. Their length of stay was 75 days, whereas the under 19 and 50+ age groups both only required a length of stay of 51 days. The 30-39-year-old age group required the highest healthcare expenditures at \$364,880 and the 50+ age group required the lowest healthcare cost \$139,145.

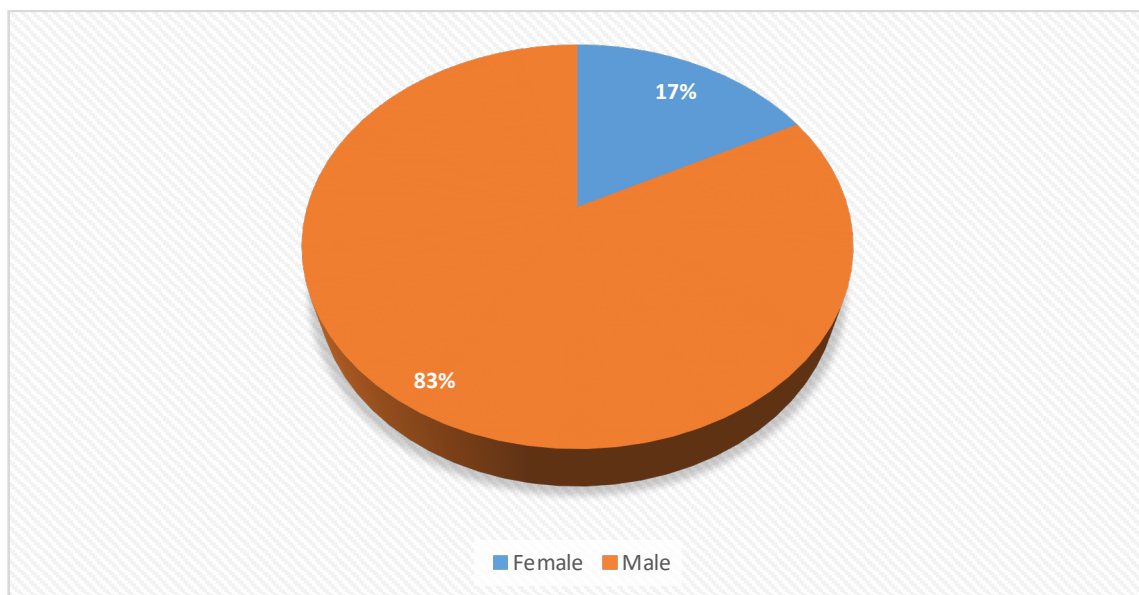


Figure 9. Gun Violence-related Healthcare visits by Sex.

Males were five times more likely to be the victim of gun violence. 82.65% of the victims of gun violence were male compared to only 17.35 % that were female (Figure 9). There were 34 cases of gun violence among female victims who required emergency department or hospital care in comparison to 162 male victims of gun violence in 2016 from the sample.

Table 6. The Cost of Firearm Injury by Gender

Gender	Length of Stay	Frequency	Percent	Cost
Female	76 Days	34	17.35	\$ 211,362
Male	262 Days	162	82.65	\$ 1,155,488

There is differential total length of stay for hospitalization and treatment after a firearm injury by sex (Table 6). Males accounted for more treatment and costs from firearm injury in each category, they required more days in the hospitals, and they had higher frequencies of gun violence 162 (82.65%). In South Carolina males incurred the highest total healthcare cost for firearm injuries at \$1,155, 488 in comparison to the female health care cost of \$211,362.

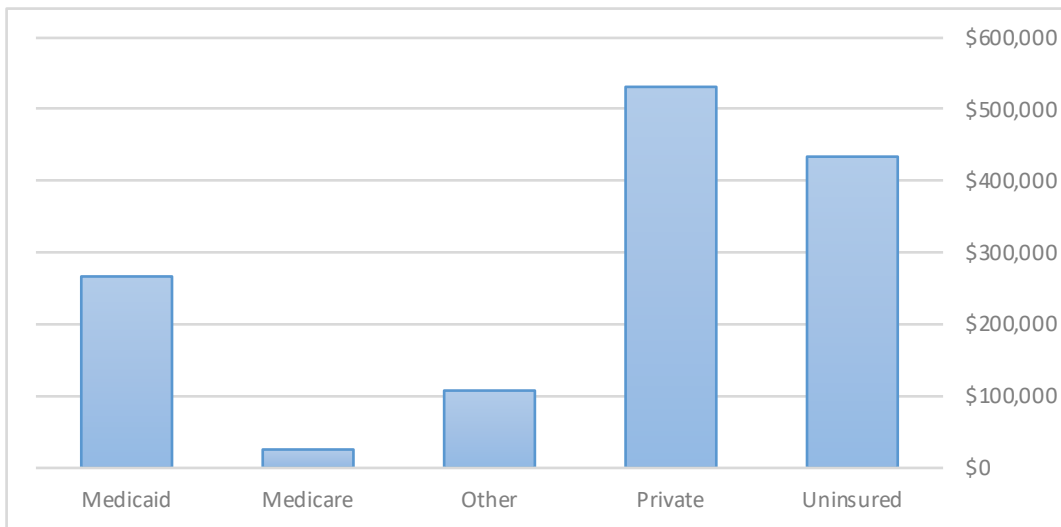


Figure 10. The Financial Burden of Gun Violence on The Healthcare Industry

The total cost per payer category of health care for those injured by gun violence was high. Medicaid cost was \$267, 159, Medicare was \$25,702, Other was \$107,935, Private was \$531,715 and Uninsured was \$434, 339 (Figure10, Table 7). The cost of health care for the uninsured was nearly a half a million dollars that had to be absorbed by the hospital system as a whole in the state. A large proportion of these health care cost had to be absorbed by government-funded insures such as Medicaid and Medicare.

Table 7. The Cost of Healthcare by Insurance Type

Insurance	Length of Stay	Frequency	Percent	Cost
Medicaid	105 Days	44	22.45	\$267,159
Medicare	26 Days	11	5.61	\$25,702

Other	26 Days	15	7.65	\$107,935
Private	81 Days	46	23.47	\$531,715
Uninsured	100 Days	80	40.82	\$434,339

As Table 7 indicates Medicaid recipients required the longest total length of stay at 105 days, however Private Insurers were responsible for the highest total healthcare costs. The uninsured had the second highest cost of healthcare from firearm injury at \$434,339 nearly a half a million dollars.

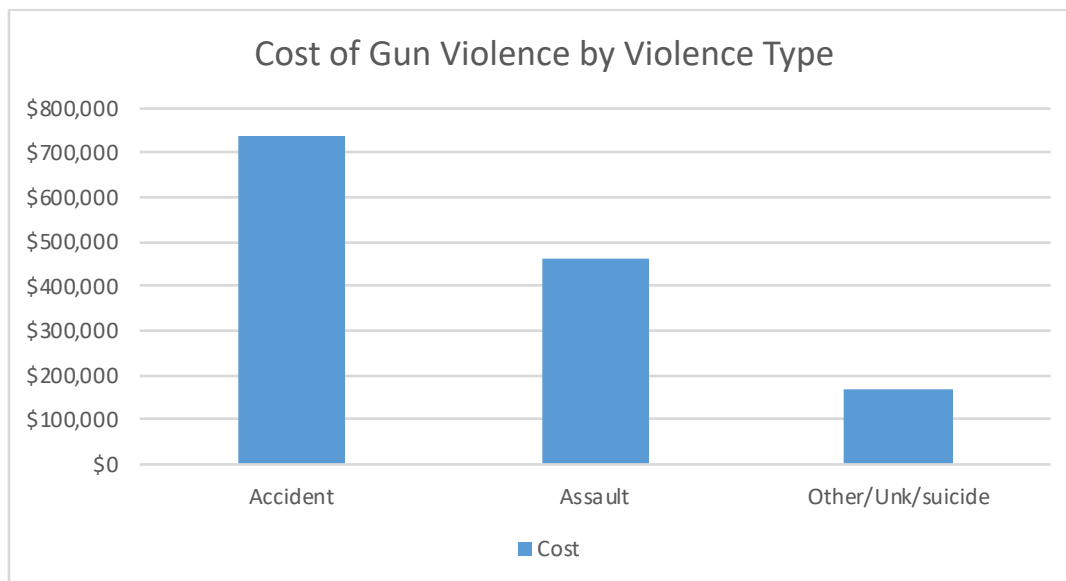


Figure 11. Total healthcare costs by type of gun violence in 2016

The highest financial burden of firearm injury in South Carolina on the healthcare system is due to accidental shootings. There were 132 accidental shootings from our sample of 196 patients. Accidental shooting reporting rely on an individual's

self-reporting the type of gun violence they endured. This may include accidents and intentional shootings that may be called accidental by the victims or perpetrators of firearm violence. Accidental shootings resulted in total healthcare costs of \$ 737,428.

Assaults accounted for the second largest number of patients from gun violence entering South Carolinas emergency departments in 2016. Assaults were the second costliest form of firearm violence in the state. This form of gun violence accounted for \$462,812 in healthcare cost. There were 49 patients treated for assaults in the ED or hospital (Figure 11, Table 8). All other forms of gun violence were accounted for under the title of other, unknown and suicide. The expenditures for firearm care in the emergency department related to other/unknown and suicide was \$166,610 was the healthcare cost for 15 shooting victims from the sample of 196 victims (Figure 11, Table 8).

Table 8. The Burden of Gun Violence by Violence Type

Violence Type	Length of Stay	Frequency	Percent	Cost
Accident	204 Days	132	67.35	\$737,428
Assault	97 Days	49	25.00	\$462,812
Oth/Unk/Suicide	37 Days	15	7.65	\$166,610

As Table 8 indicates those treated for accidental gun violence required the longest length of stay as well as having the most frequencies of firearm injury. These patients also had the highest percentage of incidents and cost the most to care for. The health care

cost for accidental firearm injury was \$737,428 and had the longest lengths of stay at 204 days, assaults required the second longest length of stay at 97 days nearly half what those that were injured by accident required. The frequency for the assault group was 49 (25%) and less than half of those were treated for accidents which were 132 (67.35%). The cost for the assault group was \$462,812. The other, unknown/suicide group had the shortest length of stay at 37 days and the lowest frequency of 15 (7.65%) and a cost of \$166,610.

CHAPTER V

DISCUSSION

In general, firearm violence in South Carolina results in death prior to utilization of healthcare services. Of our sample of 196 individuals, 7 died during hospitalization, compared with 884 additional reported deaths outside of the healthcare setting.

Although the financial cost of caring for the victims of gun violence may not be huge, the burden of gun violence is felt most by hospitals (due to the large proportion of uninsured) and public insurers. This issue should also be of interest to Private Insurers as they bear the burden of a large portion of costs.

When examining healthcare-related gun violence, South Carolina's rural counties are some of the most impacted. Many of the rural counties have higher percentages of gun violence than some of the more populated counties in the state. Several of the rural counties that have high proportions of gun violence are along the I-95 corridor, which is also known for poorer health and reduced access to medical care.

The largest healthcare-related gun violence burden falls on individuals under 40 years old, with a large portion under 19. This age group may still need education on negotiating skills and other means to handle anger driven situations to help decrease the episodes of gun violence. Gun violence in this working-age population might also impact employer insurance, profits, and may even result in job losses for individuals who miss work, or their family members who care for them.

Society sustains the largest loss related to gun violence since many of its victims are not survivors. This data does not reflect how gun violence impacts many family members. Furthermore, the data does not identify how many of the 196 patients require social services or vocational services. We do not know the number of children impacted by firearm violence that they witness or the loss of parents due to this violence. Little quantitative evidence is known of the psychological impact of gun violence on families. Future research should examine the broader impact of gun violence on society and families.

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