



Atrium Health



# A Public Health Approach to Addressing Gun Violence

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Implementing Hospital-Based Solutions to Address Social Determinants of Health that Contribute to Gun Violence

# Executive Summary

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Gun violence is surging nationally, including in many of the communities served by Atrium Health. In 2022, motivated by a desire to prevent hospital readmissions due to repeated gun violence and to address social determinants of health that contribute to the problem, Atrium Health launched a hospital-based violence intervention program. The program, implemented in partnership with the City of Charlotte and based at Atrium Health Carolinas Medical Center, is designed to assess the needs of patients admitted to the hospital with firearm injuries and connect them with community resources that can help them implement productive solutions to their life challenges.

This report reviews the short- and long-term effects of gun violence on the physical and mental health of patients, physicians and caregivers, as well as the financial impact on both patients and health systems. It describes the development and implementation of the violence intervention program at Atrium Health and expected long-term results based on national trends.

# Understanding the Impact of Gun Violence

A steady increase in gun violence rates over the last decade nationwide is taxing the capacity of trauma centers and requiring the health care systems to increase spending related to treating long-term, adverse outcomes in survivors, including substance abuse, psychiatric disorders, recurrent violent injuries and chronic pain. Families of survivors and communities with rising rates of gun violence also suffer adverse outcomes.

In 2020, there were 45,222 people who died of gun injuries in the U.S., up from 39,707 in 2019 and a nearly 25% increase over 2015, according to the Centers for Disease Control (CDC).<sup>1</sup> A CDC study examining the impact of COVID-19 on firearm injuries found that in 2020, 53% of all suicides and 79% of all homicides involved guns. The rate of homicides committed with firearms rose 34% from 2019, while the suicide rate stayed steady.<sup>2</sup> But that data doesn't tell the full story of the impact. Each year, nationally, there are an estimated 40 times as many firearm injuries as there are deaths and 70,000 emergency room visits,<sup>3</sup> data compiled by RAND Corporation shows.

In North Carolina, the rate of firearm injury hospitalizations has exceeded the national average every year since 2000,<sup>4</sup> according to RAND. In July 2022, the Charlotte-Mecklenburg Police Department reported that firearm assaults have risen in the city by 25% over five years, and they are particularly concerned about high rates of gun violence among juveniles. In the first six months of 2022 alone, an estimated 118 juveniles in the city were suspects in gun crimes, while 482 children were victims.<sup>5</sup> In the year ending September 2022, there were 20 mass shootings in North Carolina, according to the nonprofit [Gun Violence Archive](#), which defines mass shootings as any assault in which there are four or more injuries or deaths, not including those of the perpetrator. Two of the mass shootings occurred in Charlotte.

“Many people think gang violence is the problem in Charlotte, but that’s not what we are seeing

at our trauma center,” said [Dr. David Jacobs](#), Director of Atrium Health’s hospital-based violence intervention program. “What we’re seeing is that someone steps on someone else’s foot at a party or pushes them on the basketball court and then guns are being used to settle arguments.”

Atrium Health has seen a steady rise in gunshot wound cases over the past five years. In 2021, the health system treated 703 patients with injuries from gun violence, up from 457 in 2017. Of the patients treated in 2021, 9% were between the ages of 15 and 19 and 5% were under 15. By contrast, in 2017, 7% of patients were between 15 and 19, while just 2% were younger than 15.

For patients who survive gun violence, the impact of the injury – physical and mental – can be wide-ranging. A Harvard-led study of 6,498 survivors of gun violence found that pain diagnoses rose 249% and mental health disorders, including post-traumatic stress disorder (PTSD), increased by 200% in the first month following the injury.<sup>6</sup> A study by the National Bureau of Economic Research concluded that students who experience a school shooting in their sophomore or junior year of high school are 10% less likely to attend college. Those who do pursue a college education are 15% less likely to earn a bachelor’s degree by age 26.<sup>7</sup>

In 2018, Atrium Health researchers published a [study](#) in the Journal of Surgical Research investigating admissions and readmissions among 1,215 patients treated at the Atrium Health Carolinas Medical Center emergency

## Atrium Health has seen a steady rise in gunshot injuries, as well as an increase in injuries among children and teenagers.

Gunshot wounds	2017	2018	2019	2020	2021	2022 (Q1-Q2)	Grand Total
Pediatric (0-14.99 yrs.)	10	23	18	27	35	16	129
Teen (15-17.99 yrs.)	31	34	44	70	65	39	283
Adult (18-64.99 yrs.)	403	441	468	663	590	262	2827
Geriatric (>=65 yrs.)	13	16	12	10	13	7	71
<b>Grand Total</b>	<b>457</b>	<b>514</b>	<b>542</b>	<b>770</b>	<b>703</b>	<b>324</b>	<b>3310</b>

room with non-accidental gunshot wounds, stab wounds or blunt assault-related injuries between 2009 and 2015. They discovered that, among those admitted with such injuries, 25% were readmitted for violence-related injuries within 21 to 31 months. Assault victims had a 9.3% increased mortality risk, versus a 2.1% risk among patients admitted with non-violent injuries. Mortality risk was significantly higher among gun violence patients than it was for patients admitted with other types of violent injuries.<sup>8</sup>

The researchers also found that nearly 14% of readmissions were due to suicide attempts or suicidal ideations – highlighting not only the negative psychological effects of violence, but also the potential value of screening patients for mental health disorders prior to discharge, the authors suggested.

The long-term effects of violence cause significant financial challenges for patients and the health care system, both at a local and national level. Atrium Health's study found that patients who sustained violent injuries had median hospital charges of \$23,712 versus \$20,462 for those with nonviolent injuries. Some patients had hospital charges as high as \$50,000 for their initial treatments, and the average charge for subsequent violence-related injuries was \$57,031. Overall hospital charges for violent injuries treated by Atrium Health reached \$53.3 million over the seven-year study period.

It is also worth noting 46% of patients treated for violent injuries did not have health insurance, and another 37% were covered by Medicaid or

Medicare. This results in financial losses for the system, not only for the initial, up-front treatment, but also any subsequent treatment related to the challenges frequently faced by this patient population. In most instances, reimbursement rates paid by government payors is less than the actual cost of providing care. Atrium Health patients without insurance receive a 50% discount off gross charges for all medically necessary hospital treatment and, in many cases, are entitled to charity care, with the entire cost of treatment absorbed by the hospital system.

The financial impact of gun violence is a large and growing problem across the country. A 2021 study by the U.S. Government Accountability Office (GAO) found that patients admitted to the hospital with gun-related injuries, including those caused by accidents or self-harm, cost an average of \$30,693 to treat. The GAO estimated that the total initial cost of treating patients with gun injuries is at least \$1 billion a year, with Medicaid and other public coverage sources bearing more than 60% of the cost burden.<sup>9</sup> One year of hospital data examined by the GAO revealed that nearly \$300 million in charges for inpatient hospital stays were incurred by patients injured by gun violence who had no insurance coverage – a significant burden for hospitals, which are forced to absorb most of the cost of uncompensated care. One study found that health care visits and costs were 3 to 20 times higher in the six months following a firearm injury than they were during the six months preceding the injury.<sup>10</sup>



The financial burden of gun violence is felt far beyond health systems, however. Firearm injuries cause \$53.8 billion in lost income due to patient death or disability, time that caregivers take away from work and perpetrator incarceration, according to the gun violence prevention organization Everytown for Gun Safety.<sup>11</sup> Children with gunshot wounds have a 50% chance of disability, one study estimated.<sup>12</sup>

Everytown estimates that the total annual cost of gun violence in North Carolina is more than \$19.5 billion. That figure encompasses immediate costs such as police investigations and health care; subsequent costs, including long-term mental health care and physical rehabilitation; and quality of life lost over time due to pain and suffering of patients and their families.

The City of Charlotte announced its intention to treat violence as a public health crisis in 2020<sup>13</sup> and, as part of that plan, it partnered with Atrium Health in 2021 and awarded it a \$500,000 grant to launch a new violence-intervention program. The program is designed to reduce the chances that patients injured by gun violence will be readmitted to the hospital with violence-related injuries in the future. Atrium Health violence-intervention specialists interview patients who are admitted with gun injuries, with the goal of understanding the social determinants of health that contribute to violence in their lives and helping patients to address those risks.

“This type of violence occurs in disinvested and neglected communities, those with food and housing insecurity, poor educational opportunities, and a lack of access to health care, among other inequities,” Jacobs said. “It’s not as simple as controlling the flow of firearms into these communities. We want to address those underlying issues and social deficiencies and get people invested in making their communities healthier and safer.”



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– Dr. A. Britton Christmas, Medical Director of Trauma, Atrium Health

## Social Determinants of Health that Contribute to Gun Violence

Addressing social determinants of health in an effort to prevent repeat injury related to gun violence requires striking a balance between understanding both the socioeconomic factors at play and behavioral issues that can be difficult to uncover.

Atrium Health’s study of patients injured by violence found that 87% were male. African Americans were, by far, the largest racial group affected, at 65%, and 19% of patients were earning incomes that were below the median income of their neighborhood. These factors can contribute to downstream effects of food and housing insecurity and a lack of access to health care.

Other research has uncovered social determinants of health for violence that are related to family and community. For example, studies of domestic violence victims have pinpointed hopelessness, unemployment, substance abuse and a lack of role models as circumstances common among patients who arrive at trauma centers with violent injuries.<sup>14</sup>

Atrium Health invests in addressing social determinants of health across the communities it serves. It is focusing on employment, affordable housing and food security. In implementing the violence intervention program, it puts in place procedures for assessing gun-violence patients in the trauma center for all the social determinants



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– Dr. Layla Soliman,  
Forensic Psychologist,  
Atrium Health Behavioral  
Health Charlotte

that contributed to their violence-related injury. The goal is to connect patients to resources that can help them address those issues and make positive changes in their lives that will reduce the probability they will encounter violence in the future.

“You have to look at it from a societal standpoint and treat it as a much bigger issue than guns,” said [Dr. A. Britton Christmas](#), medical director of trauma for Atrium Health. “By investing in their communities, hospitals can help to show people the way out of violent lifestyles.”

Even though firearm injuries and deaths disproportionately affect racial minorities, efforts to assess trauma in patients and develop strategies to mitigate the risk of future violence are often not tailored to patients' individual cultures, communities or life circumstances.

At the American Academy of Psychiatry and the Law conference in 2022, three clinicians from Atrium Health proposed a multidisciplinary approach to identifying patients at risk for repeated violent injuries and connecting those patients with hospital- and community-based resources that can address risk factors. Recommended strategies include deploying

behavioral health specialists to assess risk for suicide and violent behavior in patients, training physicians in firearm-injury prevention and implementing counseling programs that are specific to firearms. One such program, CALM (counseling on access to lethal means), involves engaging patients in conversations about family traditions, culture and beliefs related to firearm ownership.

“We tend to talk about gun violence as if it is all one issue, and sometimes that's colored by a political narrative,” said [Dr. Layla Soliman](#), a forensic psychologist at Atrium Health Behavioral Health Charlotte. “We are proposing a shift in thinking so we're not taking a one-size-fits all approach. Hospitals can take a proactive approach to mitigating gun violence by bringing clinicians from many specialties together to treat patients. It's not about politics. It's about meeting patients where they are.”

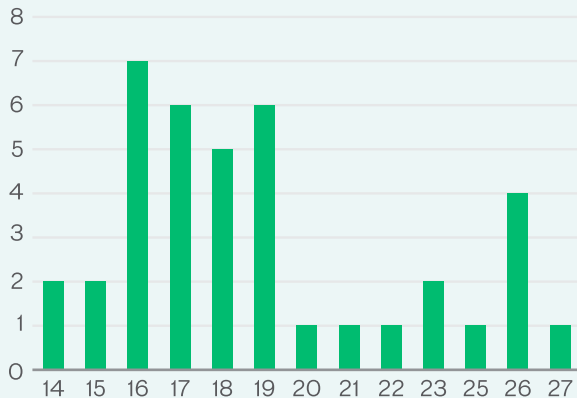
## The Evolution of a Hospital-Based Violence Intervention Program

Hospital-based violence intervention programs are growing in popularity: The first was established in the mid-1990s, and there are now more than 40 such programs in the U.S., according to the [Health Alliance for Violence Intervention](#).

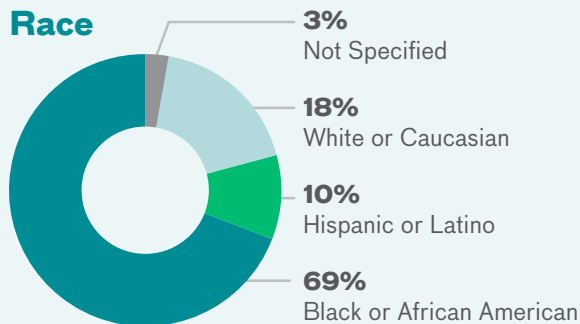
The violence intervention program at Atrium Health Carolinas Medical Center is the latest addition to a set of initiatives the health system had previously launched to target specific populations susceptible to gun violence. They include the Domestic Violence Healthcare Project, a team of advocates who help victims of intimate partner abuse transition to safe living environments, and the Carolinas Center for Injury Prevention, which works with community leaders to develop educational and research programs aimed at reducing youth violence.

## Data on Age, Race, Gender and Mechanism of Injury of Patients Admitted to Atrium Health's Violence Intervention Program in the First Six Months

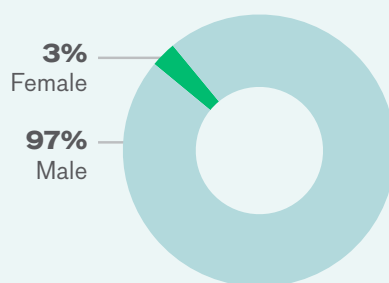
### Age



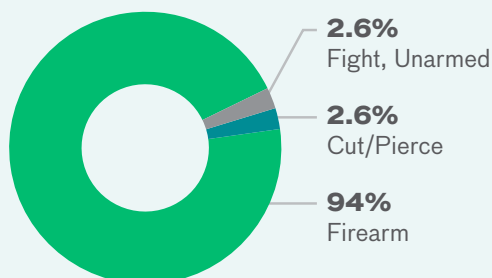
### Race



### Gender



### Mechanism of Injury



We ask them whether they have insight into what caused them to be a victim of violence. Are they engaging in high-risk behaviors, like buying or selling drugs? Then we set about formulating options – prescription if you will – that will hopefully minimize their chances of becoming a victim of violence again.

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Violence Intervention  
Program, Atrium Health

The violence intervention program at Carolinas Medical Center serves patients between the ages of 15 and 24 who present with violence-related injury. As the physical injuries are being treated, a violence intervention specialist interviews the patient to assess his or her social circumstances, including living arrangements, employment status, neighborhood characteristics, and propensity to engage in high-risk behaviors, such as drug and alcohol use.

The violence intervention specialists assist in helping patients with urgent needs, such as filling and paying for prescription medicines. Then, they create a long-term plan for connecting patients with resources in the community that can help them address persistent problems. The intervention specialists follow up with patients in the program two weeks after discharge, then 30, 60 and 90 days afterwards. They can create longer-term follow-up plans for patients if needed.

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Atrium Health launched the violence intervention program in January 2022 and

enrolled 39 patients during the first six months of the program. All but one was male and 17 were under the age of 18.

Of those enrolled, 69% were Black or African American, 10% were Hispanic or Latino and 18% were White or Caucasian. The majority of patients were admitted with firearm injuries.

During discussions with Atrium Health's violence intervention specialists, patients identified goals in several areas, including improving their access to education, housing, food and clothing. The most requested service was assistance in finding employment and/or job training.

"Often, they're interested in finding work when they get out of the hospital, just to keep busy or to get them out of the environments that caused their injuries in the first place," said Brittney Brown, the coordinator of the violence intervention program. "A big part of my job is to create 'warm handoffs.' I refer patients to organizations that can help with employment, as well as housing, education and other resources."

For example, Atrium Health works closely with Urban League of Charlotte, which offers employment assistance designed to help African American men.

Requests for mental health services are also common among patients who participate in Atrium Health's violence intervention program. One man who was treated for a gun violence injury reported to Brown that a family member had witnessed the shooting and was suffering from post-traumatic stress disorder. She connected both to counseling services, with positive results, she said.

Research collected by the Health Alliance for Violence Intervention demonstrates the long-term effectiveness of hospital-based programs. One study that examined eight years of electronic health record data in Indianapolis found that the rate of reinjuries in patients with violence-related injuries was 4.4% among participants in hospital-based violence intervention programs. By contrast, a review of 19 studies on violent injuries nationwide showed a median reinjury rate of 27.3%.<sup>15</sup>

Several studies of hospital-based violence intervention programs have shown they can significantly reduce violence in their communities. One randomized controlled trial of African American men referred to hospital-based violence intervention programs found that the likeliness of them being convicted of any crime was half that of patients who did not participate in the program. Program participants were six times less likely to return to the hospital with violent injuries.





# Conclusion

A steady increase in gun violence in the U.S. is a public-health crisis, pressuring hospitals to respond with innovative services designed to help patients with firearm injuries address the root causes of violence in their lives and reduce their chances of sustaining repeat injuries from violent events.

In 2018, Atrium Health researchers published research showing that 25% of adult patients treated at Atrium Health Carolinas Medical Center's emergency room for violent injuries, including firearm wounds, suffered additional violent injuries during the seven-year study period. Hospital charges for violently injured patients were \$53.3 million, with 46% of patients not having any health insurance and an additional 37% covered by Medicaid or Medicare (which customarily pay less than the cost of care delivery), placing a significant financial burden on the hospital and on taxpayers.

With the goal of stemming gun violence in the community, Atrium Health implemented a violence-intervention program that involves assessing patients in the hospital for social determinants of health that contribute to violence, and matching them with community resources to help address those issues. Atrium Health clinical leaders believe the program's interdisciplinary approach to violence intervention could be a model for other hospital systems to follow.

**For more information, contact [media@atriumhealth.org](mailto:media@atriumhealth.org).**

## Hospitals Step Up to Assess Trauma in Pediatric Violence Victims

The number of children and teenagers injured or killed by guns continues to rise in this country. In 2020, there were 5,141 children aged 17 or younger who sustained injuries resulting from firearms, up from 3,817 the year before, according to the Gun Violence Archive. A 2021 study by Stanford University researchers estimated there are about 4,700 pediatric firearm-related admissions each year, with a median cost of \$12,984 per patient.<sup>16</sup>

The link between childhood violence and mental health disorders later in life has been well-established. The Centers for Disease Control (CDC) and Kaiser Permanente have been investigating the impact of violence on children since 1995 through the [Adverse Childhood Experiences \(ACE\) study](#). Among the findings: Childhood trauma is associated with employment difficulties,<sup>17</sup> illicit drug use<sup>18</sup> and an increased risk of attempted suicide later in life.<sup>19</sup>

The rise in pediatric gun violence, coupled with the risk it poses to mental health, has prompted calls for hospitals to take a more active role in assessing mental trauma in young victims. In 2022, the American College of Surgeons updated its [standards](#) for optimal care of injured patients to include requirements that all patients, including children, with violent injuries

be screened for acute stress disorder and post-traumatic stress disorder (PTSD).

To prepare to implement the guidelines, researchers at Atrium Health tested three different trauma-screening questionnaires in a study that enrolled 52 pediatric trauma patients. Parents were asked to complete the questionnaires in the hospital and complete follow-up surveys 30, 60, and 90 to 120 days after discharge. They found that the prevalence of acute stress disorder in pediatric violence victims was 41% and PTSD was reported in 31% of patients.<sup>20</sup>

Atrium Health is now implementing two of the screening tools it tested into its treatment of pediatric patients with injuries from gun violence: the Child Stress Disorders Checklist (CSDC) and the Acute Stress Checklist (ASC) for Children.

“By intervening early with these patients, the goal is to help them understand the trauma experienced and guide them into a recovery process,” said [Dr. James Rachal](#), associate professor of psychiatry and academic chair for the department of psychiatry for Atrium Health, in Charlotte. “We hope to mitigate the risk they’ll be retraumatized or engage in violent behaviors themselves.”

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