United States Government Accountability Office

Report to Congressional Requesters

June 2021

FIREARM INJURIES

Health Care Service Needs and Costs

GAO@100
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GAO-21-515

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Highlights

Highlights of GAO-21-515, a report to congressional requesters.

June 2021

FIREARM INJURIES

Health Care Service Needs and Costs

Why GAO Did This Study

In 2019, close to 40,000 people died from a firearm injury in the U.S., and around twice that number sustained non-fatal injuries. Over 100 organizations representing health care providers consider the number of firearm injuries that occur each day to be a public health epidemic. Health care costs associated with firearm injuries—both those for services provided during initial hospital treatment and those for services provided long-term—are paid for, at least in part, by public payers, such as Medicaid and Medicare.

GAO was asked to review the health care costs of firearm injuries. This report describes the initial hospital costs of firearm injuries in the U.S. and what is known about the costs of subsequent care, as well as the post-discharge services that may be needed to treat these injuries.

GAO analyzed hospital data for 2016 and 2017 collected by the Agency for Healthcare Research and Quality related to the initial costs of treating firearm injuries, and conducted a literature review on the health care costs of these injuries following discharge. In addition, GAO moderated meetings with 12 experts, representing clinicians, economists, and others—selected with assistance from the National Academies of Sciences, Engineering, and Medicine—to discuss the post-discharge health care service needs and costs of firearm injuries.

The Department of Health and Human Services provided technical comments on a draft of this report, which GAO incorporated as appropriate.

View GAO-21-515. For more information, contact Carolyn L. Yocom at (202) 512-7114 or yocomc@gao.gov.

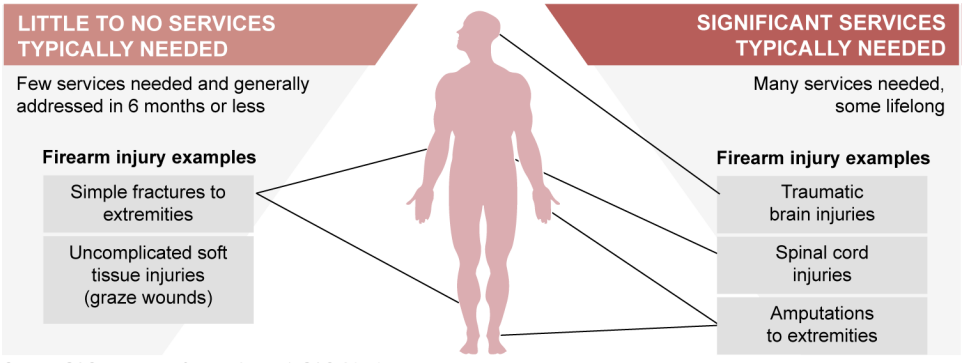
What GAO Found

There is no complete information on the health care costs of firearm injuries. National data allow for estimates of the costs of initial hospital treatment and some first-year costs, but less is known about costs the more time passes from the injury. Examining available data and information, GAO found the following:

- **Initial hospital costs:** Using hospital data from 2016 and 2017—the most recent that were available—GAO estimated that the initial hospital costs of firearm injuries were just over $1 billion annually. However, physician costs not captured in the data could add around 20 percent to that total. GAO also found that each year there were about 30,000 inpatient stays and about 50,000 emergency department visits to initially treat firearm injuries, and that patients with Medicaid and other public coverage accounted for over 60 percent of the costs of this care.
- **First-year costs:** Findings from studies on health care costs within the first year of hospital discharge after a firearm injury suggest that those costs can be significant. For example, studies estimating first-year hospital readmissions costs found that up to 16 percent of firearm injury survivors with an initial inpatient stay were readmitted at least once for their injury, with average costs of $8,000 to $11,000 per patient.
- **Long-term costs:** Less is known about the costs of health care for firearm injuries beyond the first year after hospital discharge. GAO identified studies that estimated lifetime costs of these injuries, but the estimates relied on data from over 20 years ago, making them no longer a reliable indicator of costs.

Clinical experts GAO met with described a wide range in both physical and behavioral health care needs for firearm injury survivors after hospital discharge, with some survivors needing lifelong care. These experts also told GAO that survivors often face barriers to receiving needed care, such as being denied care when it is not covered by their insurance. While not receiving needed services may minimize costs initially, the consequences of unmet health needs for firearm injury survivors may ultimately result in greater costs.

Range of Physical Health Care Needs for Firearm Injuries after Hospital Discharge



Source: GAO summary of expert input. | GAO-21-515

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Abbreviations

AHRQ	Agency for Healthcare Research and Quality
CDC	Centers for Disease Control and Prevention
ED	emergency department

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June 16, 2021

The Honorable Carolyn B. Maloney
Chairwoman
Committee on Oversight and Reform
House of Representatives

The Honorable Elizabeth Warren
United States Senate

The Honorable Robin Kelly
House of Representatives

In 2019, close to 40,000 people died from a firearm injury in the United States, and available information suggests around twice that number sustained non-fatal injuries.[1] Over 100 organizations representing health care providers consider the number of firearm injuries that occur each day to be a public health epidemic. According to the Centers for Disease Control and Prevention (CDC), those who survive firearm injuries may face significant health consequences. These can include physical disabilities, neurological problems, and chronic mental health issues, such as post-traumatic stress disorder. Research indicates that the largest share of the costs of treating firearm injuries may be borne by public payers, particularly Medicaid, the federal-state health financing program that covers over 70 million Americans.[2]

While prior studies have looked at various aspects of the health care costs of firearm injuries, certain information is lacking. Specifically, existing studies provide more information on costs associated with initial

[1]For fatality estimates, see Centers for Disease Control and Prevention (CDC), National Center for Health Statistics, "All Injuries," *FastStats*, accessed April 15, 2021, https://www.cdc.gov/nchs/fastats/injury.htm. The estimated number of non-fatal firearm injuries was not available from CDC for 2019 due to data reliability concerns. For recent estimates of non-fatal injuries based on hospital discharge data see, Elinore J. Kaufman, Douglas J. Wiebe, and Ruiying A. Xiong, "Epidemiologic Trends in Fatal and Nonfatal Firearm Injuries in the US, 2009-2017," *JAMA Internal Medicine*, vol. 181, no. 2 (2021): p. 237-244.

[2]See, for example, Corinne Peek-Asa, Brandon Butcher, and Joseph E. Cavanaugh, "Cost of Hospitalization for Firearm Injuries by Firearm Type, Intent, and Payer in the United States," *Injury Epidemiology,* vol. 4, no. 20 (2017); and Sarabeth A. Spitzer et al., "Costs and Financial Burden of Initial Hospitalizations for Firearm Injuries in the United States, 2006-2014," *American Journal of Public Health*, vol. 107, no. 5 (2017): p. 770-774.

hospital treatment either in the emergency department (ED) or after admission (referred to in this report as an inpatient stay), and do not represent the most recent years of available data. As a result, how the health care costs of firearm injuries may have changed in recent years, as well as costs after discharge from the hospital—such as those from rehabilitation and behavioral health care services—are less well understood.[3]

Because of the gaps in information on the health care costs of firearm injuries and the potential share of those costs that may be borne by the public, you asked us to further assess these costs. In this report, we describe

1. the initial hospital costs of firearm injuries in the United States, including the costs to public payers; and
2. the physical and behavioral health care services that may be needed for survivors of firearm injuries after hospital discharge and what is known about the costs of this care.

To describe the initial hospital costs of firearm injuries in the United States, including the costs to public payers, we analyzed 2016 and 2017 hospital discharge data—the most recent years of data available at the time of our analysis—from the Agency for Healthcare Research and Quality's (AHRQ) Healthcare Cost and Utilization Project.[4] Specifically, we used data from AHRQ's Nationwide Emergency Department Sample to estimate the national prevalence and costs of initial hospital visits where all treatment was provided in the ED (i.e., the visit did not result in a patient being admitted for inpatient care in the same or a different hospital). We refer to these visits as ED-only in this report. We used data from AHRQ's National Inpatient Sample to estimate the national prevalence and costs of initial inpatient stays, including those where care

[3]Behavioral health care services include those to treat mental health conditions, such as post-traumatic stress disorder or depression, as well as to treat substance use disorder, which occurs when the recurrent use of alcohol, opioids, or other drugs causes significant impairments.

[4]AHRQ is the primary federal agency collecting hospital administrative data. The Healthcare Cost and Utilization Project includes a number of databases with clinical and non-clinical variables from community hospital discharge records, including diagnosis and procedure codes, which are used to uniformly describe a patient's medical condition for billing and claims reimbursement.

began in the ED.[5] Our analysis included fatal and non-fatal firearm injuries where hospital care occurred, but not injuries where individuals died before reaching the hospital. We examined the prevalence and costs of firearm injuries by a number of variables, such as expected payer and injury site (i.e., body region).[6] Finally, we examined the prevalence and costs of these injuries by various patient demographic characteristics, as well as the geographic region where care was provided, and compared our results to distributions for the U.S. population. Costs estimated represent the costs incurred by hospitals for providing services—not payments actually received—and were inflation-adjusted to 2017 dollars.[7]

To assess the reliability of the data that we used, we interviewed relevant officials, reviewed related documentation, compared our estimates with prior literature, and performed electronic testing to identify missing data and obvious errors. On the basis of these steps, we determined that the data were sufficiently reliable for the purposes of our reporting objectives. See appendix I for further details on our methodology and tables with estimates of prevalence and costs for the 2-year period we studied.[8]

To describe the physical and behavioral health care services that may be needed for survivors of firearm injuries after they are discharged from the hospital—ranging from services needed immediately following discharge to those needed lifelong—and what is known about the costs of this care, we convened panels of experts and conducted a literature review. Specifically, to obtain information on post-discharge health care service needs, we worked with the National Academies of Sciences, Engineering,

[5]The Nationwide Emergency Department Sample and the National Inpatient Sample are all-payer health care databases and reflect a 20 percent stratified sample of all U.S. hospital-owned EDs and a 20-percent stratified sample of all U.S. community hospital inpatient discharge records, respectively. Both databases reflect encounters, and thus, patients could be represented more than once if they had more than one initial encounter for a firearm injury in the 2-year period we studied.

[6]Health Care Cost and Utilization Project databases are billing databases and as such, include information on expected, not actual payers. According to AHRQ officials, expected payer and actual payer are closely aligned, though there can be some exceptions, for example, due to state coding practices. Records include information on expected primary payer and sometimes expected secondary or tertiary expected payers. Our analysis was based on expected primary payer.

[7]To adjust costs for inflation, we used the Personal Health Care Expenditure component of the National Health Expenditure Accounts per AHRQ's recommendation.

[8]We produced estimates with totals for the 2 years and, in certain cases, annual estimates. For both types of estimates, we used pooled data for 2016 and 2017.

and Medicine (National Academies) to identify and convene a panel of eight clinical experts with experience in treating individuals with firearm injuries—such as trauma surgeons, rehabilitation specialists, and a social worker—as well as in conducting related research. Experts provided information on the types and duration of care needed for different types of firearm injuries and potential barriers to that care.[9]

To obtain information on what is known about the costs of care for firearm injuries after initial hospital discharge, we conducted a structured review of peer-reviewed literature and government reports and reviewed various cost estimates included in the literature.[10] We also convened a panel of four experts in economics—with the assistance of the National Academies—to discuss the strengths and limitations of the studies identified through our literature review, as well as the challenges to estimating costs of post-discharge care for firearm injuries. To pre-test our questions for both panels, we interviewed a clinician who also had experience researching firearm injuries. In addition to our expert panels, we interviewed CDC officials. See appendices II and III for further details on the expert panels and literature review, respectively.

We conducted this performance audit from April 2020 to June 2021 in accordance with generally accepted government auditing standards. These standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

Background

Firearm Injuries

A firearm injury is an injury caused by a weapon—such as a handgun, rifle, or shotgun—that uses a powder charge to power a projectile (i.e., a bullet). Firearm injuries may result from attempts at self-harm, accidents (such as during cleaning), interpersonal violence (such as gang-related or domestic violence), or be inflicted by law enforcement officials on active duty. The type of firearm involved in the injury and the cause of the injury

[9]When considering post-discharge physical and behavioral health care needs, we asked experts to consider the typical course of treatment that an injury would need. For physical health care services, we used internal clinical expertise to develop a table that outlined the type and duration of services that would typically be needed for different firearm injuries, and adjusted it based on feedback from experts on the panel.

[10]In summarizing these estimates, we did not inflation-adjust them to current dollars.

can have implications for the type of injury sustained. For example, injuries resulting from attempts at self-harm are more often fatal than those resulting from an assault. Non-fatal firearm injuries can range from graze wounds to more severe penetrating injuries, such as when a bullet severs the spinal cord, resulting in paralysis.

Firearm Injury Treatment

Some individuals shot by a firearm die instantly, but more will need treatment for their injuries. Most firearm injuries are treated, at least initially, in the ED. While some of the injuries may be fully treated in the ED, others may require an inpatient stay.

- **ED-only care:** Some firearm injuries only receive ED treatment, but this can still include a range of services. For example, in some cases, a person may die from a firearm injury while in the ED after extensive care was provided. In other cases, only minor ED treatment is needed before a person is discharged, such as with an uncomplicated graze wound.
- **Inpatient stays:** Firearm injuries that result in hospital admission are typically more severe than those where the patient is discharged from the ED. The level and type of inpatient care needed may depend on the area of the body affected (e.g., head or extremities); the severity of the injury; and whether multiple injuries occurred, among other factors. Inpatient care often includes one or more surgeries and may require time in an intensive care unit.

After hospital discharge, some firearm injury survivors will require additional heath care services in order to restore medical and functional capacity and to prevent health deterioration. The need for these services can be short-term, intermittent, or lifelong; and treatment can occur in a variety of settings, including at home, on an outpatient-basis, or in a specialized facility.[11] As with other types of traumatic injuries, the health care needs after a firearm injury could include both physical health care services and behavioral health care services. (See text box.)

[11]Facilities providing services after hospital discharge vary in the care they provide. For example, post-acute inpatient rehabilitation facilities can provide intensive rehabilitation services to patients with spinal cord injuries, brain injuries, and other neuromuscular conditions. Skilled nursing facilities provide short-term nursing or rehabilitation services on an inpatient basis, but generally cannot provide the same level of specialized care.

Examples of Services that May Be Needed after Discharge from Initial Hospital Treatment of a Firearm Injury

Physical Health Care

- Inpatient and outpatient rehabilitation, including occupational and physical therapy.
- Additional surgery (e.g., reconstruction for a facial wound).
- Additional hospital care (e.g., readmission to treat conditions resulting from the injury, such as infections).
- Long-term services and supports (e.g., care in a nursing facility or home health care).
- Durable medical equipment (e.g., wheelchairs and prosthesis).
- Prescription drugs (e.g., those needed to manage pain).

Behavioral Health Care

- Crisis care (e.g., call centers) to immediately address a mental health crisis.
- Outpatient therapy, including short-term and long-term meetings with a mental health provider.
- Inpatient care to manage an acute mental health episode.
- Prescription drugs to manage mental health conditions.
- Substance use disorder services (e.g., detoxification from opioids or other substances).

Source: GAO. | GAO-21-515

Firearm Injury Treatment Payers

The health care costs of treating a firearm injury can involve a number of different payers, both public and private. For example, individuals may lose employer-based private health insurance if their injuries render them disabled and unable to work, at which point they may become eligible for public coverage, such as Medicaid or Medicare. In addition, individuals may share the costs of care with their insurer, including by paying premiums, co-payments, or deductibles. Public and private payers include the following:

- **Medicaid:** Medicaid is a federal-state program that finances health care for low-income and medically needy individuals. When uninsured individuals come to a hospital for care, they can be assessed for Medicaid eligibility on the basis of income and enrolled.[12] Eligibility for Medicaid and the level of coverage for certain services can vary state to state. For example, as of April 2021, 38 states and the District of Columbia have expanded Medicaid eligibility to non-disabled,

[12]Such enrollment is referred to as presumptive eligibility. Individuals must still submit a full Medicaid application and be approved in order to remain enrolled in the program.

nonelderly adults as provided under the Patient Protection and Affordable Care Act.[13]

- **Medicare:** Medicare is the federal health insurance program that covers people age 65 and older, certain individuals with disabilities, and those with end stage renal disease. Medicaid may supplement Medicare coverage for those meeting eligibility requirements by providing assistance with Medicare premiums and cost sharing, as well as by covering services not included in Medicare, such as long-term services and supports.[14]
- **Other public payers:** Examples of other public payers include federal health benefit programs run through the Department of Defense and the Department of Veterans Affairs. Individuals covered by Department of Defense and the Department of Veterans Affairs programs may receive care at federally run facilities, but may also receive care at community providers.
- **Private health insurance:** Private insurance may be employer-based or an individual or small-group policy. The amounts and types of care covered, as well as the amount individuals must share in the cost of care varies across insurance plans. The amount insurers pay for care also varies, as individual insurers negotiate prices with providers. Private insurance purchased through health insurance exchanges established under the Patient Protection and Affordable Care Act may be subsidized by the federal government.[15]
- **Self-pay:** Individuals who do not have health insurance are responsible for paying providers directly. If the individual cannot pay,

[13]Under the Patient Protection and Affordable Care Act, enacted on March 23, 2010, states may opt to expand their Medicaid programs to cover nonelderly, nonpregnant adults who are not eligible for Medicare, and whose income does not exceed 133 percent of the federal poverty level beginning January 1, 2014. Pub. L. No. 111-148, 124 Stat. 119 (2010), as amended by the Health Care and Education Reconciliation Act of 2010, Pub. L. No. 111-152, 124 Stat. 1029 (2010).

[14]Long-term services and supports may be provided in institutional, home, or community-based settings and can comprise a broad range of health care, personal care, and supportive services to help individuals with activities of daily living, such as bathing, eating, and using the toilet.

[15]The Patient Protection and Affordable Care Act required the establishment of health insurance exchanges—markets that operate within each state's overall individual and small group market where eligible individuals and small employers can compare and select among qualified insurance plans offered by participating issuers. See Pub. L. No. 111-148, § 1321, 124 Stat. 119, 186 (2010). Depending on their income, individuals purchasing coverage through the exchanges may be eligible for financial assistance in the form of premium tax credits and cost-sharing reductions.

their costs may be considered uncompensated care, for which hospitals can receive additional Medicaid and Medicare support.[16]

Initial Hospital Costs of Firearm Injuries Were over $1 Billion per Year; Patients with Medicaid and Other Public Coverage Accounted for Over Half of These Costs

We estimated that the costs of initial ED and inpatient care for firearm injuries in the United States were just over $1 billion each year in 2016 and 2017, based on hospital discharge data from AHRQ. However, physician costs not captured in the data could add around 20 percent to that total. Our analysis also found that patients with Medicaid and other public coverage accounted for more than half of these annual costs, and that firearm injuries disproportionately occurred within certain demographic groups and regions of the country.

Estimates of Initial Hospital Costs of Firearm Injuries in the United States Totaled Over $1 Billion Annually, but Do Not Include All Costs

Based on hospital discharge data from AHRQ, we estimated that the costs of initial ED and inpatient care for firearm injuries in the United States were just over $1 billion each year in 2016 and 2017.[17] However, our estimates do not include certain costs that would add to the annual total. In particular, they do not include the costs of physicians providing hospital care, referred to as professional fees, as these costs are not typically captured in hospital discharge data.[18] Ratios developed by staff at CDC suggest that including professional fees could increase our

[16]For more information, see GAO, *Hospital Uncompensated Care: Federal Action Needed to Better Align Payments with Costs*, GAO-16-568 (Washington, D.C.: June 30, 2016).

[17]Over the 2-year period, the estimated cost of this care was more than $2.1 billion.

[18]Costs that can be estimated from discharge data are facility fees, which hospitals charge payers to cover most items related to hospital care, such as the costs of equipment, room and board, or non-physician staff. Professional fees are charged separately and cover hospital services provided by physicians and other skilled health care professionals licensed for independent practice.

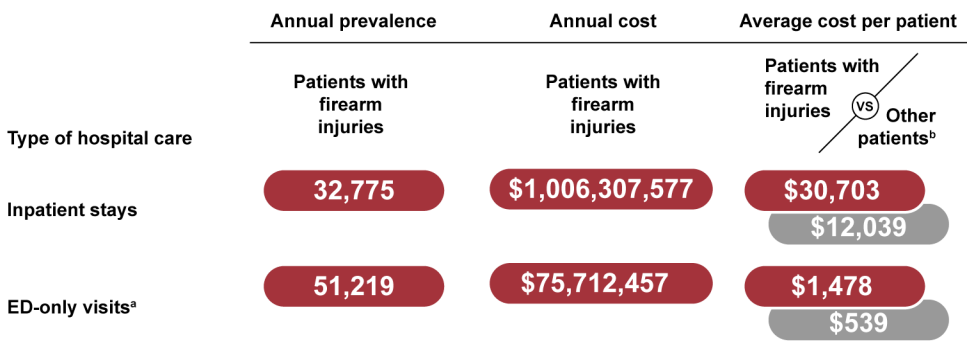
annual cost estimates by around 20 percent.[19] Other costs not included in our estimates are likely smaller in magnitude as compared with professional fees.[20] (See app. I for more information on the costs not included in our estimates.)

We found that the initial hospital costs of firearm injuries were largely driven by inpatient stays, which accounted for over 90 percent of the annual total hospital costs for firearm injuries in 2016 and 2017. However, in terms of prevalence, firearm injuries where patients received ED-only treatment were more common, with about 50,000 such visits per year, compared with about 30,000 inpatient stays annually. Our analysis also suggests that, while firearm injuries constitute a small proportion of overall hospital costs—less than 1 percent over the 2-year period we studied—per patient, these injuries are relatively expensive to treat compared with other types of injuries or conditions. For example, we found that in 2016 and 2017, the average cost of initial treatment for firearm injury patients—whether ED-only or inpatient care—was more than twice the average cost of treating other patients in the hospital. (See fig. 1.)

[19]See Cora Peterson et al., "Professional Fee Ratios for US Hospital Discharge Data," *Med Care,* vol. 53, no. 10 (2015): p. 840-849. The ratios—defined as total payments divided by facility-only payments—were developed using ICD-9 health insurance claims data from 2012 and earlier, and, because our analysis was based on ICD-10 hospital cost data from 2016 and 2017, we did not incorporate them into our dataset. However, to get a sense of magnitude, we applied the article's 2012 adjusted mean payment ratios specific to payer and setting of care (ED-only and inpatient stays) to our annual cost totals. CDC officials said that staff are planning to update these ratios, and that the analysis would likely be completed in late 2021 or early 2022.

[20]Other costs not included in our estimates were ambulance transportation costs, federal hospital costs, and certain ED costs.

Figure 1: Estimated Annual Prevalence and Costs of Initial Hospital Care for Firearm Injuries in the United States, 2016-2017



Source: GAO analysis of Agency for Healthcare Research and Quality's Healthcare Cost and Utilization Project Nationwide Emergency Department Sample and National Inpatient Sample data. | GAO-21-515

Notes: Estimates presented are annual estimates based on pooled data from 2016 and 2017. Costs were inflation-adjusted to 2017 dollars and represent the costs to hospitals for providing services. The estimates do not account for non-facility costs, such as professional fees, or for care at non-community hospitals, such as federal hospitals run by the Department of Veterans Affairs, the Department of Defense, or Indian Health Service.

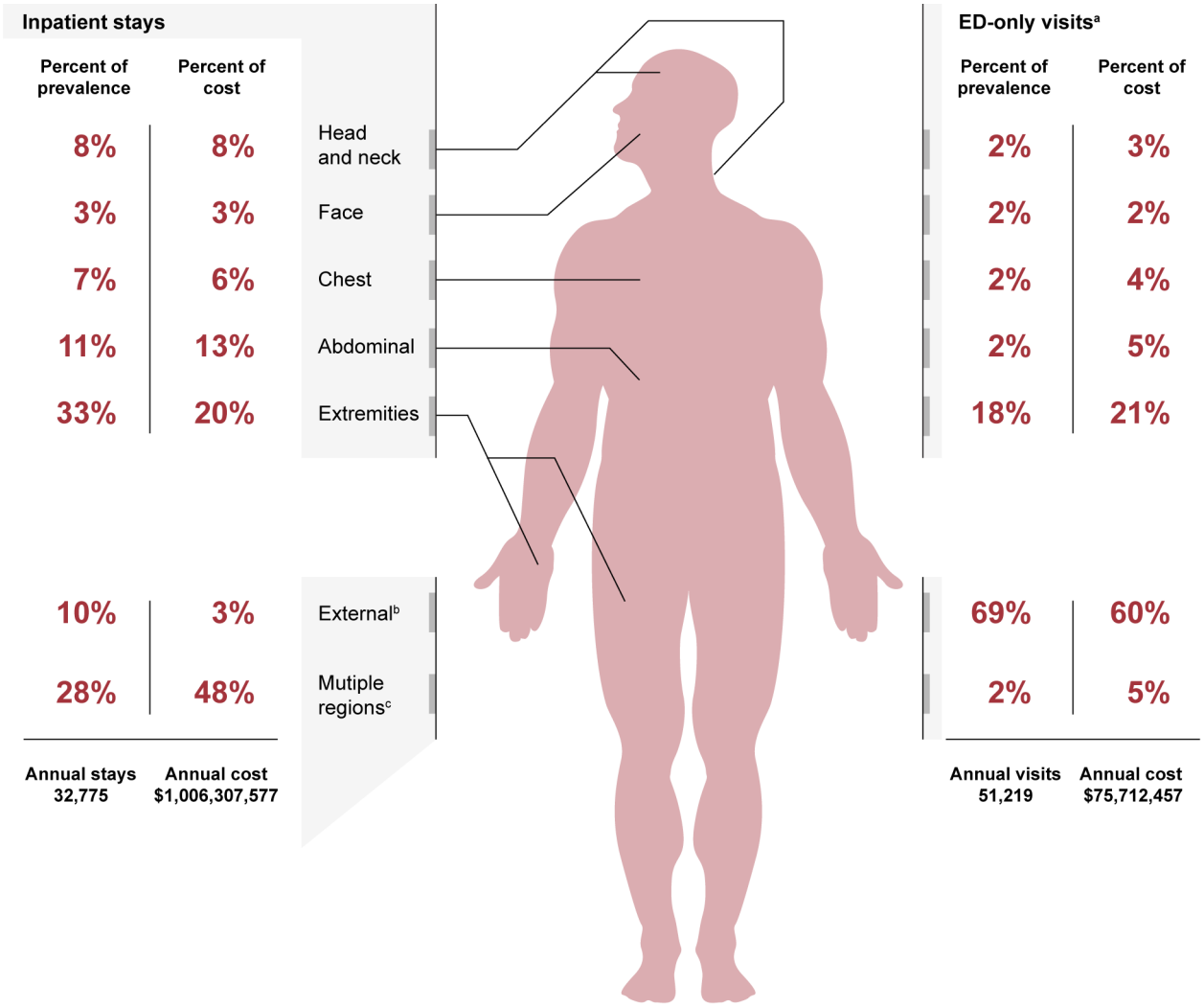
The estimates in this figure have a relative standard error of 8 percent or less. Relative standard error is the standard error divided by the estimate itself. According to the Agency for Healthcare Research and Quality, estimates with a relative standard error of 30 percent or more do not have reliable precision.

[a]Emergency department (ED) only visits are those where the patient was discharged without an inpatient stay (i.e., the patient was not admitted to the same hospital or transferred to a different hospital). Ten percent of ED-only visits were dropped from our analysis due to missing cost information.

[b]Other patients were any patients included in the data who were not identified as receiving initial treatment for a firearm injury.

When using AHRQ's data to examine the initial hospital costs of firearm injuries by certain injury characteristics, we found a different distribution of costs for inpatient stays compared with ED-only visits. For example, when we looked at the anatomic location of injuries, injuries to multiple body regions accounted for an estimated 48 percent of annual costs for inpatient stays in 2016 and 2017, but only 5 percent of ED-only costs. Conversely, external injuries (i.e., those that affected the skin, but did not injure any underlying structures, such as internal organs) accounted for 3 percent of annual inpatient costs, but an estimated 60 percent of ED-only costs. (See fig. 2.)

Figure 2: Estimated Annual Prevalence and Cost of Initial Hospital Care for Firearm Injuries in the United States, by Body Region, 2016-2017



Source: GAO analysis of Agency for Healthcare Research and Quality's Healthcare Cost and Utilization Project Nationwide Emergency Department Sample and National Inpatient Sample data. | GAO-21-515

Notes: Percentages may not add to 100 because of rounding and because a small percentage of injuries (1.5 percent for inpatient stays and 3.2 percent for emergency department (ED) only visits) could not be categorized by body region.

Estimates presented are annual estimates based on pooled data from 2016 and 2017. Costs were inflation-adjusted to 2017 dollars and represent the costs to hospitals for providing services. The estimates do not account for non-facility costs, such as professional fees, or for care at non-community hospitals, such as federal hospitals run by the Department of Veterans Affairs, the Department of Defense, or Indian Health Service.

The numerical estimates in this figure all have a relative standard error of less than 8 percent. Relative standard error is the standard error divided by the estimate itself. According to the Agency for Healthcare Research and Quality, estimates with a relative standard error of 30 percent or more do not have reliable precision.

[a]ED-only visits are those where the patient was discharged from the ED without an inpatient stay (i.e., the patient was not admitted to the same hospital or transferred to a different hospital). Ten percent of ED-only visits were excluded from our analysis due to missing cost information.

[b]External injuries are those that affected the skin, but did not injure any underlying structures, such as internal organs, blood vessels, or bones.

[c]Multiple regions are injuries affecting more than one body region other than the external region, which we did not count when populating this category.

When we examined firearm injuries by severity, we found that minor to moderately severe injuries accounted for the majority of costs for both initial inpatient stays and ED-only visits over the 2-year period we studied.[21] However, patients with minor to moderately severe injuries were more frequently treated through ED-only visits and accounted for a higher percentage of the costs for this care—an estimated 96 percent compared with 63 percent for inpatient stays.

AHRQ's data also provided information on initial hospital care for firearm injuries by discharge status, including the costs of this care. For example, from 2016 through 2017:

- **Fatal injuries:** Most individuals who arrived at hospitals alive following a firearm injury survived until discharge, with about 8 percent of inpatient stays and about 10 percent of ED-only visits being fatal.[22] Patients with fatal injuries comprised an estimated 19 percent of the total costs for ED-only visits compared with 8 percent of total costs for inpatient stays.
- **Discharged to further care:** Patients who were discharged to further care, such as to a skilled nursing facility or to home health care, accounted for about 20 percent of inpatient stays and an estimated 35 percent of total inpatient hospital costs. Conversely, only 2 percent of ED-only visits had patients who were discharged to further care.
- **Routine discharges:** Routine discharges—those where patients were discharged to self-care at home—were most common for both

[21]Minor to moderately severe injuries (which we classified as those from 1 to 15 on a 75 point Injury Severity Score scale) had lower per patient costs when compared with more severe injuries. For example, our analysis of initial hospital costs found that inpatient stays for minor firearm injuries cost an estimated average of $18,062 per patient, compared with $59,367 for a severe injury. Likewise, the average initial hospital costs of an ED-only visit for a minor injury was an estimated $1,373 per patient, compared with $7,597 for a severe injury.

[22]According to a recent study, for nearly 80 percent of fatal firearm injuries, death occurred outside the hospital. See Kaufman, Wiebe, and Xiong, "Epidemiologic Trends in Fatal and Nonfatal Firearm Injuries in the US, 2009-2017."

inpatient stays and ED-only visits, accounting for an estimated 68 percent and 85 percent of each, respectively. These discharges also comprised the majority of total costs for both inpatient stays and ED-only visits.

Patients with Medicaid Coverage Accounted for Half of the Initial Hospital Costs of Firearm Injuries

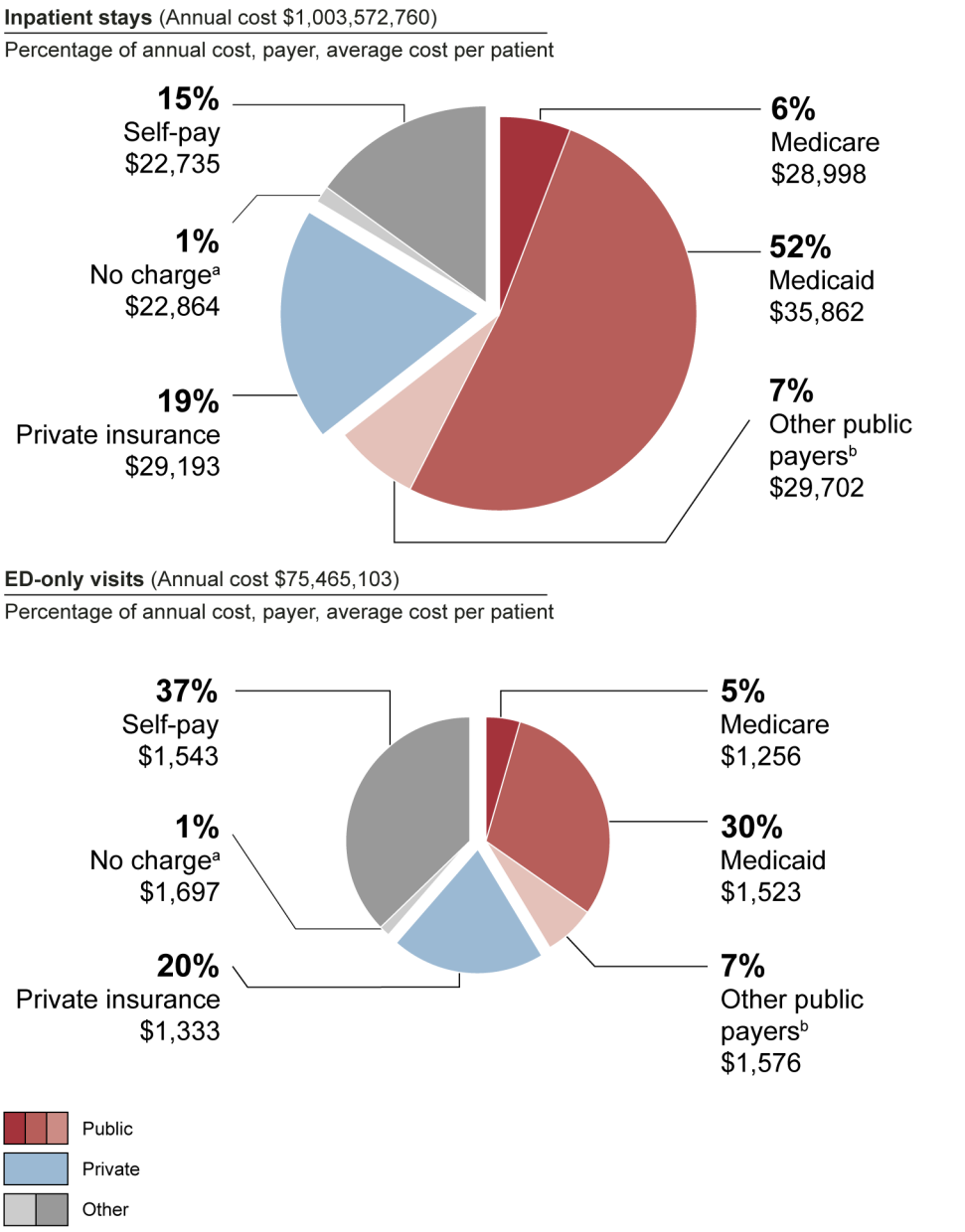
We estimated that patients with Medicaid coverage accounted for 50 percent of the approximately $1 billion in initial hospital costs of firearm injuries each year in 2016 and 2017, with the share being larger for inpatient stays compared with ED-only visits.[23] For inpatient stays, patients with Medicaid accounted for more stays than patients with other coverage and generally had higher average costs, both of which affected Medicaid's share of total costs.[24] Patients with other public coverage—including Medicare—accounted for an estimated 13 percent of total annual costs. In addition, individuals not covered by insurance (self-pay) accounted for 16 percent of total annual costs. To the extent these individuals do not pay for their care, Medicare or Medicaid uncompensated care payments may offset some of the hospitals' costs. See figure 3 for information on costs by expected payer for inpatient stays compared with ED-only visits.

[23]Patients with Medicaid coverage accounted for an estimated 52 percent of the costs of initial inpatient stays for firearm injuries in 2016 and 2017, and an estimated 30 percent of the costs of ED-only visits.

[24]Patients with Medicaid coverage accounted for an estimated 44 percent of initial inpatient stays for firearm injuries in 2016 and 2017. In contrast, Medicaid provided coverage for an estimated 21 percent of the civilian, noninstitutionalized U.S. population with Medicaid coverage during the same years.

Prior literature suggests that the higher average cost for Medicaid patients is due, in part, to length of stay. See Spitzer et al., "Costs and Financial Burden of Initial Hospitalizations for Firearm Injuries in the United States, 2006-2014."

Figure 3: Estimated Annual Initial Hospital Costs of Firearm Injuries in the United States, by Expected Payer, 2016-2017



Source: GAO analysis of Agency for Healthcare Research and Quality's (AHRQ) Healthcare Cost and Utilization Project Nationwide Emergency Department Sample and National Inpatient Sample data. | GAO-21-515

Notes: Costs presented in this figure are annual estimates based on pooled data from 2016 and 2017 and compare the costs of inpatient stays with those of ED-only visits. All costs were inflation-adjusted to 2017 dollars and represent the costs to hospitals for providing services, not what payers paid. The estimates do not account for non-facility costs, such as professional fees, or for care at non-

community hospitals, such as federal hospitals run by the Department of Veterans Affairs, the Department of Defense, or Indian Health Service. When looking at these costs combined, expected payer percentages were as follows: Medicaid, 50 percent; Medicare, 6 percent; other public payers, 7 percent; self-pay, 16 percent; no charge, 1 percent; and private insurance,19 percent (numbers do not add to 100 due to rounding).

The numerical estimates in this figure all have a relative standard error of less than 11 percent. Relative standard error is the standard error divided by the estimate itself. According to AHRQ, estimates with a relative standard error of 30 percent or more do not have reliable precision.

Expected payer is the primary payer billed for services rendered. According to AHRQ officials, expected payer and actual payer are generally closely aligned. Expected payer was missing for 0.4 percent of inpatient stays and 0.3 percent of emergency department (ED) only visits in our analysis, and, as a result, associated costs for this care were not included in the totals for this figure.

ED-only visits are those where the patient was discharged without an inpatient stay (i.e., the patient was not admitted to the same hospital or transferred to a different hospital). Ten percent of ED-only visits were excluded from our analysis due to missing cost information.

[a]No charge refers to records where the hospital does not plan to charge the patient or another payer for care provided.

[b]Other public payer includes health benefits provided through the Department of Defense, the Department of Veterans Affairs, and other government programs.

Our estimates of Medicaid's share of initial hospital costs for firearm injuries in 2016 and 2017 were higher compared with estimates of Medicaid's share of such costs in studies using data from prior years. For example, our estimate of Medicaid's share of costs for initial inpatient stays for firearm injures was about 17 percentage points higher than the program's share in a study using AHRQ data from 2006 through 2014.[25] This is, in part, because, as compared with this study, our estimate of the share of inpatient stays covered by Medicaid was also higher (about 15 percentage points), while our estimates of the share covered by self-pay and other public payers were lower (about 9 percentage points and 7 percentage points, respectively). These payer shifts are likely due, at least in part, to states' decisions to expand Medicaid under the Patient Protection and Affordable Care Act, which has been shown to increase Medicaid coverage and reduce the number of individuals without insurance, as well as associated uncompensated care.[26]

[25]See Spitzer et al., "Costs and Financial Burden of Initial Hospitalizations for Firearm Injuries in the United States, 2006-2014."

[26]See GAO-16-568.

Firearm Injuries Disproportionately Occurred Within Certain Demographic Groups and Regions of the Country; Distribution of Initial Hospital Costs Reflected Prevalence Patterns

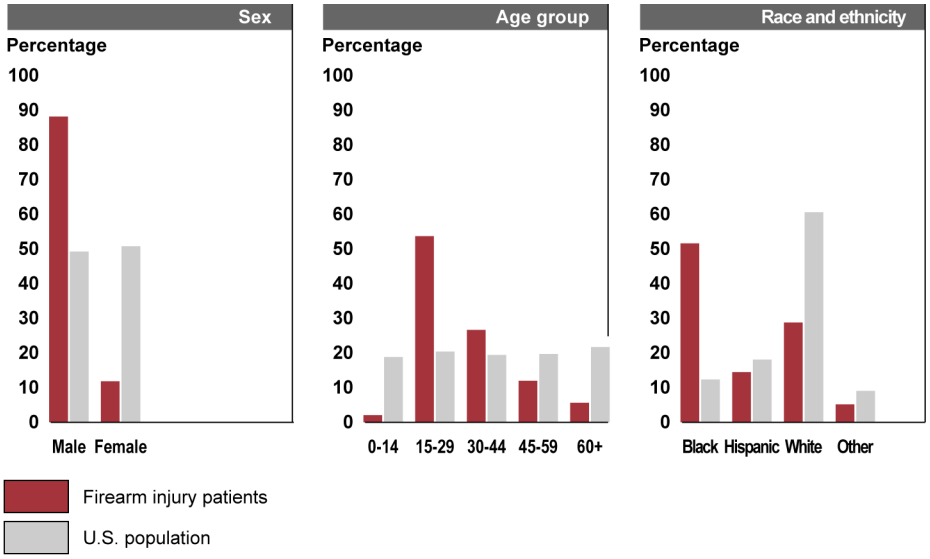
Our analysis of AHRQ's data showed that firearm injuries disproportionately occurred within certain demographic groups, and as a result, initial hospital costs were most concentrated in these groups. For example, from 2016 through 2017, men accounted for nearly 90 percent of patients receiving both initial ED-only and inpatient care for firearm injuries, as well as associated costs, and patients between the ages of 15 and 29 accounted for over half of each type of care and costs. Similarly, though information on race and ethnicity was not available for ED-only visits, patients identified as Black accounted for over half of inpatient stays and costs.[27] All three of these groups also accounted for a substantially higher share of firearm injury patients compared with their share of the U.S. population. See figure 4 for an example of this comparison based on firearm injury patients with initial inpatient stays.[28] While the data did not allow a similar comparison for income, over the 2-year period we studied, a high percentage of firearm injury patients—more than half for both initial ED-only and inpatient care—lived in zip codes with an annual median household income below $44,000.[29]

[27]While only 5 percent of observations were missing for race and ethnicity, according to AHRQ officials, these values are systematically missing from certain states and certain hospitals.

[28]The figure uses the firearm injury population with initial inpatient stays for comparison purposes. However, our analysis showed that, when available, the demographic distributions for ED-only care were not markedly different.

[29]While comparable data were not available for the U.S. population, among the total population of patients with inpatient stays or ED-only visits from 2016 through 2017, less than one-third lived in zip codes with an annual median household income in the lowest income quartile. In 2016, the lowest quartile was a median household income below $43,000 and in 2017, below $44,000.

Figure 4: Estimated Demographic Distribution of Firearm Injury Patients with Inpatient Stays Compared with the U.S. Population, 2016- 2017



Source: GAO analysis of Agency for Healthcare Research and Quality's (AHRQ) Healthcare Cost and Utilization Project National Inpatient Sample data. | GAO-21-515

Notes: We reported race and ethnicity according to the classification in AHRQ's National Inpatient Sample. Because of small sample sizes of Asian and Pacific Islanders, Native Americans, and others, we combined these groups and included them in other. While only 5 percent of observations were missing for race and ethnicity, according to AHRQ officials, these values are systematically missing from certain states and certain hospitals.

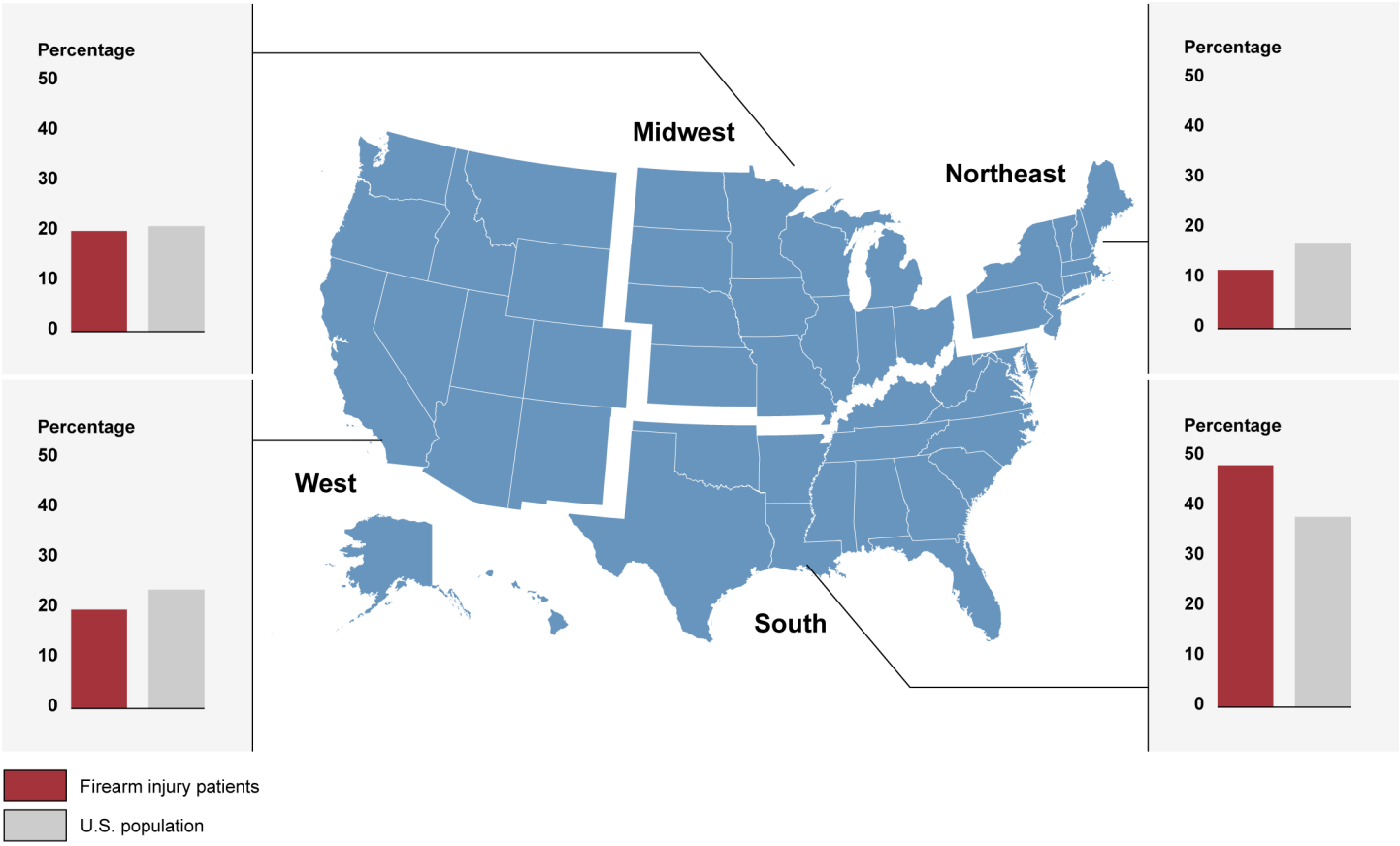
Estimated percentages for firearm injury patients were calculated from pooled data from 2016 and 2017 and reflect patients receiving initial inpatient treatment. The data do not account for care provided at non-community hospitals, such as federal hospitals run by the Department of Veterans Affairs, the Department of Defense, or Indian Health Service.

Census data presented is for 2017; however, the distribution for the U.S. population was about the same using census data for 2016.

Firearm injuries were also disproportionately concentrated in the South. For example, from 2016 through 2017, almost half of all initial inpatient stays for firearm injuries were located in the South, and the region accounted for roughly the same percentage of the costs for this care.[30] The South accounted for 38 percent of the U.S. population during the same period. (See fig. 5.)

[30]We decided not to report on ED-only distributions by region, because missing ED cost information was concentrated in the Western region of the country. However, before missing costs were dropped from our analysis, regional prevalence distributions were similar for inpatient and ED care.

Figure 5: Estimated Geographic Distribution of Firearm Injury Patients with Inpatient Stays, Compared with the U.S. Population, 2016-2017



Source: GAO analysis of Agency for Healthcare Research and Quality's Healthcare Cost and Utilization Project National Inpatient Sample data. | GAO-21-515

Notes: Regions presented are based on regional designations from the U.S. Census Bureau.

Estimated percentages for firearm injury patients were calculated from pooled data from 2016 and 2017 and reflect patients receiving initial inpatient treatment. The data do not account for care provided at non-community hospitals, such as federal hospitals run by the Department of Veterans Affairs, the Department of Defense, or Indian Health Service.

Census data presented is for 2017; however, the distribution for the U.S. population was the same using census data for 2016.

Firearm Injury Survivors Have a Wide Range of Health Care Needs after Hospital Discharge; Information on the Costs of this Care Is Limited

Clinical experts we convened told us that firearm injury survivors have a range of health care needs after hospital discharge, but may face a number of barriers to receiving care. Recent studies provide some information about the costs of care within the first year post-discharge; however, the economic experts we convened identified a number of challenges to developing more comprehensive estimates over the span of survivors' lives.

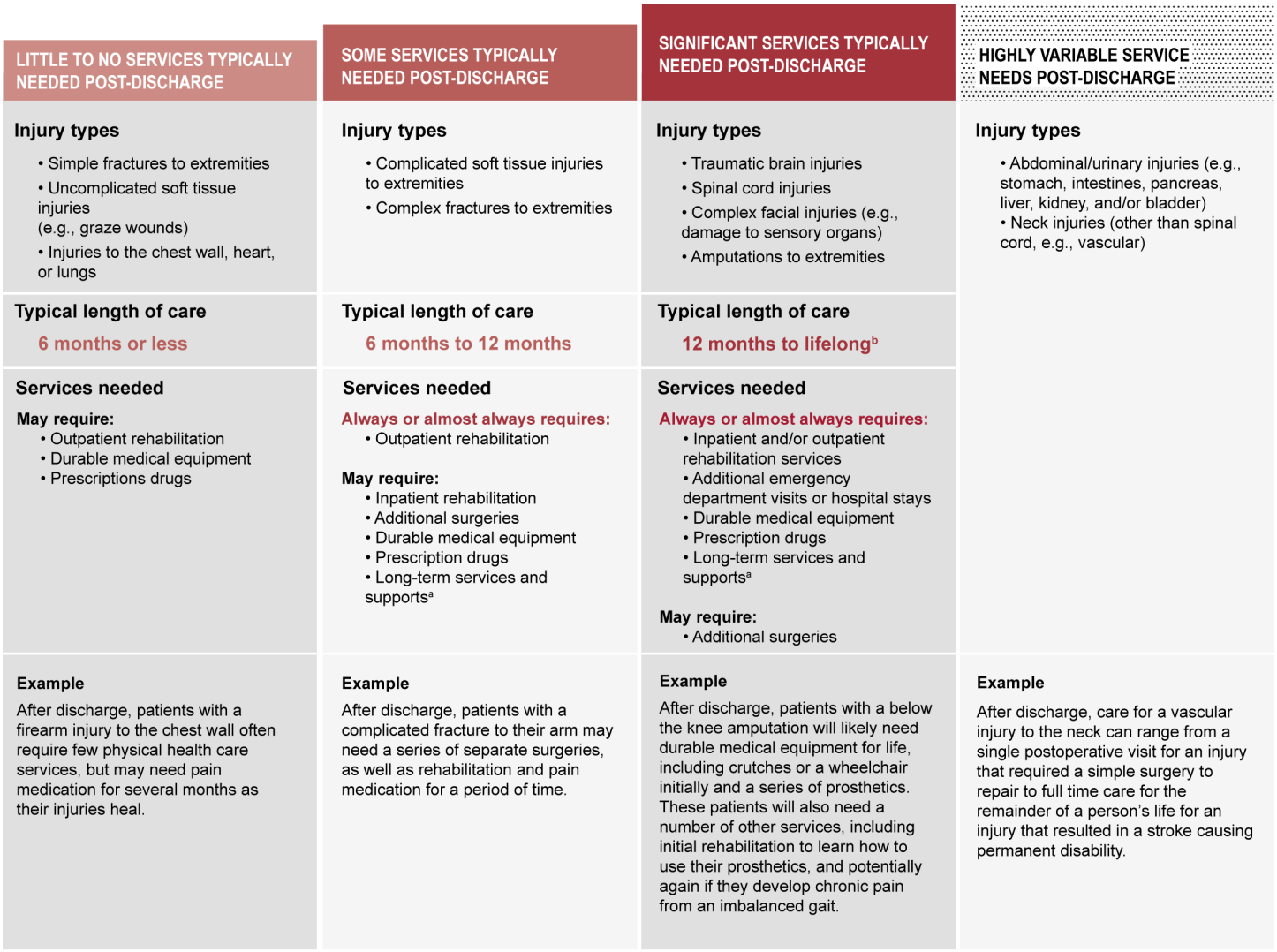
Health Care Service Needs Vary after Discharge, with Certain Firearm Injuries Requiring Lifelong Care

Clinical experts we convened told us that after discharge from initial hospital care, firearm injury survivors have a range of physical and behavioral health care needs, with some injuries requiring significant, lifelong care.

Physical Health Care Services

Clinical experts stated that survivors of firearm injuries can have a wide range of physical health care service needs after discharge from the hospital. According to experts, the types of services typically needed and for how long are primarily driven by the firearm survivor's injury type (i.e., the anatomical location and nature of the injury). (See fig. 6.)

Figure 6: Physical Health Care Service Needs for Firearm Injuries after Hospital Discharge, by Injury Type



Source: GAO summary of expert input. | GAO-21-515

Notes: This figure presents the results of feedback from eight clinical experts on information presented to them during panel discussions. Experts included trauma surgeons, rehabilitation physicians, a social worker, and others. The figure summarizes the level of physical health care experts said was needed for certain firearm injuries after discharge from the hospital, but does not necessarily reflect the level of acute care needed for these injuries.

[a]Long-term services and supports may be provided in institutional or community-based settings and can comprise a range of health care, personal care (e.g., assistance with bathing and eating), and supportive services to help individuals with limited ability for self-care.

[b]The time frame for lifelong services can vary depending on age at injury and the risk of reduced life expectancy with some injuries.

Examples of Post-Discharge Physical Health Care Service Needs When Firearm Injury Results in Spinal Cord Damage

Depending on the severity of injury, services needed can include:

- *Rehabilitation services* to regain strength and increase independence, such as gait training—practice walking with assistive devices—for patients who are able to relearn how to walk.
- *Durable medical equipment* to assist with mobility, such as braces, walkers, and wheelchairs.
- *Long-term services and supports* to help with home health care and activities of daily living, such as a personal care attendant to assist with eating and bathing.
- *Additional surgeries* to address secondary medical complications, such as pressure ulcers that result from extended periods of inactivity.

Source: GAO Auremar/stock.adobe.com (photo). | GAO-21-515

Experts told us that firearm survivors with injuries resulting in permanent disability or serious medical complications are most likely to need significant post-discharge care, sometimes for the remainder of their lives.[31] They explained that, while many of the services needed are to treat the initial injury, firearm injury survivors with these types of injuries may also develop secondary medical conditions requiring additional care. Based on our analysis of AHRQ's hospital discharge data, we were able to estimate the frequency of certain disabling injuries highlighted by experts as injuries that may require lifelong care, such as spinal cord injuries and traumatic brain injuries, and found that they make up a relatively small portion of all firearm injuries. Specifically, we estimated that in 2016 and 2017 firearms resulted in about 1,000 initial inpatient stays per year for non-fatal spinal cord injuries and about 2,000 such stays per year for non-fatal traumatic brain injuries, compared with the more than 80,000 firearm injuries that received hospital care each year overall. Other injuries the experts highlighted as needing significant care—such as vascular injuries resulting in a stroke—are not easily identified in hospital discharge data. As a result, we were not able to estimate how commonly they occur.

[31]One example experts gave of a serious medical complication was when a patient's abdominal wall has to be left open post-surgery, which is done to manage certain conditions, such as pressure build up in the abdominal cavity. Experts explained that this can lead to significant complications, including the need for additional surgeries and rehabilitation.

Clinical experts told us that, in addition to the type of injury sustained, a number of other factors could increase the need for physical health care services after hospital discharge. Some examples experts highlighted include the following:

- **Pre-existing conditions.** Experts said that firearm injury survivors with certain pre-existing conditions (e.g., obesity, high blood pressure, and asthma) can experience more medical complications than survivors who are otherwise healthy, particularly if those conditions are not well managed. One expert gave the example that a 40-year-old firearm injury patient with years of untreated high blood pressure is more likely to need an amputation and require additional services after discharge.
- **Multiple injuries.** Experts noted that individuals who sustained multiple injuries from a firearm may require physical health care services for a longer period of time, due, in part, to the need to treat the injuries separately.[32] One expert gave the example of a survivor who sustained both a spinal cord injury and an upper extremity fracture from a firearm, each of which may require a separate rehabilitation stay.
- **Extended stay in the intensive care unit.** Experts said that patients who stay in the intensive care unit for an extended period (e.g., more than 5 days) are at risk of developing a number of physical, cognitive, and psychiatric symptoms that increase the need for health care services after discharge.

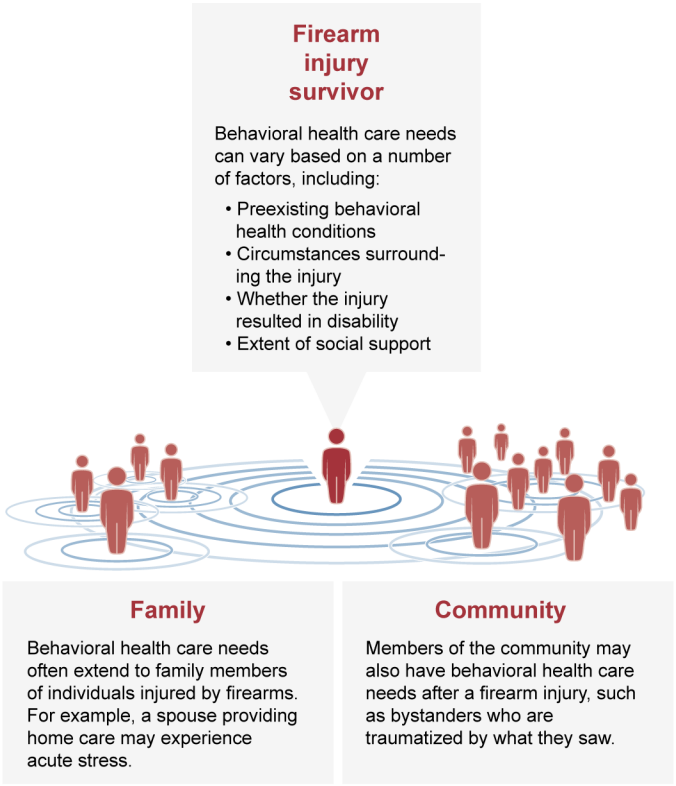
Behavioral Health Care Services

The clinical experts we convened told us that all survivors of firearm injuries are likely to need some form of behavioral health care services after their hospital discharge. They said that survivors can experience a variety of mental health conditions, such as post-traumatic stress disorder and depression, and that the type and duration of services needed can vary based on a number of factors. For example, one expert highlighted the importance of the circumstances surrounding the firearm injury, noting that the behavioral health care needs of someone injured through interpersonal violence may be different than someone with a self-inflicted injury. Additionally, experts told us that survivors' families and

[32]We found that from 2016 through 2017, inpatient stays for non-fatal injuries to more than one body region accounted for about 10 percent of firearm injuries receiving hospital care overall, and potentially more survivors sustained multiple injuries within the same body region.

communities can have behavioral health care needs after a firearm injury. (See fig. 7.)

Figure 7: Behavioral Health Care Needs after Firearm Injuries



Source: GAO summary of expert input. | GAO-21-515

Note: This figure is based on the results of panel discussions involving 12 experts, including trauma surgeons, rehabilitation specialists, a social worker, and others.

Like other traumatic events, clinical experts explained that psychological reactions to firearm injuries can differ from person to person, based on the intersection of the factors illustrated above, as well as other factors that can be more difficult to identify. Experts told us that behavioral health care needs are less dependent on injury type in comparison with physical health care needs. For example, one expert told us they had seen firearm survivors with serious, life-threatening injuries who only required a few sessions of outpatient therapy before they could adequately cope with their injuries, while other survivors with similar injuries may be in therapy after 10 years. Experts also acknowledged that injury type still plays a role. In particular, they noted that injuries leading to permanent disabilities

are more likely to require behavioral health care services. For example, experts noted that firearm injury survivors with traumatic brain injuries are more likely to need inpatient psychiatric care due to how their injuries affect their neurological functioning, which is often not well managed or understood.

Firearm Injury Survivors May Face Barriers to Receiving Needed Health Care Services after Discharge

Clinical experts we convened told us that a number of factors can create barriers to firearm injury survivors receiving the health care services they need after their discharge from the hospital. Many of the factors discussed by experts—such as type of insurance coverage, socioeconomic status, and provider biases—can affect access to health care more generally. As discussed earlier, many firearm injury survivors are from communities of color and are low income. Because of this, they may be more likely than the general population to face access barriers due to systemic inequities that disproportionately affect those groups.[33] Some examples highlighted by experts of how firearm injury survivors might face barriers to accessing needed services included the following:

- **Hospital policies and resources.** Experts told us that the policies and resources of the hospital where a firearm injury survivor is initially admitted can affect access to care after discharge. For example, one expert told us that at their hospital, surgeons cannot provide follow-up care for patients with certain types of insurance after discharge, and instead must transfer their care to the county facility. The expert explained that because county facilities often have too many patients, without someone to advocate for them, firearm injury survivors may not receive the quality of care they need or have to wait longer for care. Conversely, other experts said that their hospitals run trauma survivors clinics that provide comprehensive services for all patients that need them after their discharge. As a result, surgeons can continue to follow their patients.
- **Policies of other health care facilities.** Experts indicated that the policies of other health care facilities can also affect survivors' access to needed care. For example, experts stated that firearm injury patients may be denied entrance to post-acute inpatient rehabilitation facilities, because their insurance plans do not cover that level of care. Instead, they may end up in skilled nursing facilities or outpatient

[33]For more information on health care inequities in the United States, see Centers for Disease Control and Prevention, "Racism and Health," *Health Equity*, accessed May 10, 2021, https://www.cdc.gov/healthequity/racism-disparities/index.html; and Centers for Disease Control and Prevention, "CDC Health Disparities and Inequalities Report – United States, 2011," *Morbidity and Mortality Weekly Report* (Atlanta, Ga.: January 2011).

rehabilitation, which provide less intensive services than these patients may need. Additionally, even if firearm injury survivors do qualify for a certain facility under their insurance, experts explained that they may not be admitted, because of the violence associated with firearm injuries. (See text box.)

- **Provider prescribing practices.** Experts told us that provider prescribing patterns can be a factor in patients accessing needed care after discharge. For example, experts said that providers may not prescribe certain services, because they assume based on past experience that patients will not be covered for them under their insurance. Additionally, the expert with whom we pre-tested panel questions discussed how providers may not always prescribe services to patients from communities of color at the same level as they do to White patients, because of racial bias in the health care system.[34]
- **Patient mistrust.** Experts noted that patients may not access services prescribed to them due to mistrust of the health care system. Experts said this mistrust can stem from negative prior experiences with the health care system and lack of racial and ethnic diversity of providers within the health care system, among other things.

Example of Barriers to Accessing Rehabilitation Services for Firearm Injury Survivors Provided by Experts

Scope of the issue: Experts we convened told us that firearm injury survivors have been denied access to post-acute rehabilitation care, because of the violence associated with firearm injuries. To illustrate, one expert cited an upcoming study with preliminary findings that patients with violently acquired injuries—including firearm injuries—at a large urban hospital were less likely to be discharged to post-acute inpatient rehabilitation facilities compared with other injury patients, despite being more likely to need this level of care.

Reasons for denial: Experts explained that, without state or federal laws prohibiting screening patients based on cause of injury, rehabilitation facilities or home health agencies can choose to accept patients with injuries from falls or motor vehicles accidents instead of patients with violently acquired injuries. They said that the facilities attributed some of these denials to security concerns.

Implications: One expert said that not receiving the level of rehabilitation needed at discharge can have significant negative effects on survivors' long-term health outcomes. Additionally, this expert told us that these denials can increase health care costs, as patients denied entry into rehabilitation facilities may be kept in the hospital where care is more expensive.

Source: GAO summary of expert input. | GAO-21-515

Note: This example was raised during panel discussions involving eight clinical experts, including trauma surgeons, rehabilitation specialists, a social worker, and others.

[34]In 2003, the National Academies Institute of Medicine published a report that examined the large body of research on communities of color experiencing a lower quality of health care services compared with White patients. See Institute of Medicine, *Unequal Treatment: Confronting Racial and Ethnic Disparities in Health Care* (Washington, D.C.: The National Academies Press, 2003). In 2020, the American Medical Association issued a statement indicating that racism and unconscious bias within health care delivery have caused and continue to cause harm to marginalized communities.

While not receiving needed services may minimize costs initially, the consequences of barriers that result in unmet health needs for firearm injury survivors may ultimately result in greater costs. For example, one expert noted that firearm injury survivors who do not receive the physical health care services they need for their injuries face a greater risk for co-morbidities and hospital readmission. Experts also stated that if survivors' behavioral health care needs are not addressed, they may self-medicate with drugs and alcohol, potentially requiring substance use disorder treatment.[35]

Recent Studies Provide Some Information on the Health Care Costs of Firearm Injuries within a Year of Discharge; Challenges Exist to Developing More Comprehensive Cost Estimates

We identified recent studies with estimates of the cost of care for firearm injuries in the first year after hospital discharge, and their findings suggest that costs can be significant.[36] For example, studies that examined the cost of hospital readmissions within a year of initial discharge found that anywhere from around 6 percent to 16 percent of firearm injury survivors nationwide were readmitted at least once due to their initial injury, with average costs per readmission ranging from about $8,000 to $11,000.[37] Additionally, a study examining a broader set of services found that firearm injury survivors who had been admitted to the hospital had, on average, about a $23,000 increase in private health insurance payments in the year after discharge as compared with the year before their injuries.[38] (See table 1.)

[35]We have previously reported that health care costs for acute treatment for untreated behavioral health conditions, such as the cost of hospitalization, can be higher than the costs of ongoing treatment (e.g., weekly visits to a mental health professional). See GAO, *Behavioral Health: Research on Health Care Costs of Untreated Conditions is Limited,* GAO-19-274 (Washington, D.C.: Feb. 28, 2019).

[36]These studies were published between 2018 and 2020 and used data from one or more years between 2010 and 2017.

[37]The study that found around 6 percent readmission rate was examining readmissions for firearm injuries within one month of initial discharge, and the study that found around a 16 percent readmission rate was examining readmissions within 6 months. Additionally, one study found that around 3 percent of all firearm injury survivors were readmitted to the hospital two or more times within 6 months of discharge. See Spitzer et al., "Readmission Risk and Costs of Firearm Injuries in the United States, 2010-2015," *PLoS ONE*, vol. 14, no. 1 (2019).

[38]See Megan Ranney et al., "Increases in Actual Health Care Costs and Claims after Firearm Injury," *Annals of Internal Medicine*, vol. 173, no. 12 (2020): 949-955. This study was based on data from private insurance plans from five states between 2015 and 2017, and the authors noted that, because they looked at all health care claims following hospital discharge, their estimates likely included at least some payments that are not directly attributable to the injury.

Table 1: Examples of Estimates of the Health Care Costs of Firearm Injuries in the First Year after Hospital Discharge

Cost estimated	Time period from discharge studied	Estimate (dollars)
Costs per readmission	Within 1 month	8,311 (median)[a]
	Within 6 months	10,377 (average, men)[b]
		10,965 (average, women)[b]
	Within 1 year	10,108 (median)[a]
Total readmission costs	Within 1 month	54.2 million (for 2-year period)[a]
	Within 6 months	86 million (annual)[c]
	Within 1 year	131 million (for 2-year period)[a]
Average increase in health insurance payments	Within 6 months	8,136 (after emergency department only)[d]
		17,389 (after inpatient stay)[d]
	Within 1 year	10,196 (after emergency department only)[d]
		22,713 (after inpatient stay)[d]

Source: GAO summary of reviewed studies. | GAO-21-515

Notes: All estimates of the cost of readmission are based on nationally representative patient samples, and the estimates of changes to average health insurance payments are based on patient claims data from private insurance plans from five states.

[a]Rishi Rattan et al., "Hidden Cost of Hospitalization after Firearm Injury: National Analysis of Different Hospital Readmission," *Annals of Surgery*, vol. 267, no. 5 (2018): p. 810-815. This study used data from 2013 to 2014.

[b]Yi Zuo et al., "Sex Differences in Early Cardiovascular and All-Cause Hospitalization Outcomes After Surviving Firearm Injury," *American Journal of Men's Health*, vol. 12, no. 4 (2018): 1029-1038. This study used data from 2013 to 2014.

[c]Sarabeth Spitzer et al., "Readmission Risk and Costs of Firearm Injuries in the United States, 2010-2015," *PLoS ONE*, vol. 14, no. 1 (2019). This study used data from 2010 to 2015 and inflation-adjusted its estimates to 2015 dollars. The annual estimate from this study may be higher than estimates from other studies, because it accounted for the fact that the National Readmission Database only counts readmissions in the same calendar year as the initial admission; thus, without adjusting, a patient discharged in, for example, December would only have readmissions counted for at most a month.

[d]Megan Ranney et al., "Increases in Actual Health Care Costs and Claims after Firearm Injury," *Annals of Internal Medicine*, vol. 173, no. 12 (2020): 949-955. This study used data from 2015 to 2017.

We also identified several studies estimating the lifetime health care costs of firearm injuries, but the estimates were outdated. The most recent study was published in 2007 and all studies identified relied on data from over 20 years ago. Because of changes in health care delivery, utilization, and service costs, those data are no longer good indicators of health care costs. One of the economic experts we convened noted that a limitation of these studies is that they all used an analysis of workers' compensation claims from the 1980s to estimate longer-term costs, such as those that occurred 18 months or more after discharge. The expert explained that this workers' compensation data was unique in that it could definitively identify the costs that already resulted from an injury and

included actuarially determined future health care costs until death. However, the expert said that the analysis has never been updated and the data are no longer available for research purposes.[39] (See app. III for studies discussed here, as well as other studies in our literature review.)

The economic and clinical experts we convened identified a number of challenges to developing comprehensive estimates of the health care costs of firearm injuries after hospital discharge, particularly estimates beyond the first year that capture all relevant health care services. For example:

- **Limited longitudinal, patient-level data.** Experts mentioned that it can be challenging to collect health care data on firearm injury survivors over longer periods of time, because individuals frequently switch between types of health insurance. In the absence of a national unique patient identifier, there may be no way to tie claims data to firearm injury survivors when such switches occur.[40]
- **Difficulty linking services to initial injury.** Experts noted that firearm injuries may not be linked to subsequent health care services—particularly those outside of a hospital setting—in health insurance claims data. For example, despite diagnosis codes now distinguishing between initial visits, follow up visits, and visits for subsequent conditions attributable to an initial injury, experts said that providers do not always code these visits correctly.[41]
- **Difficulty estimating costs of behavioral health care.** One expert stated that it is difficult to estimate the costs of behavioral health care services for firearm injury survivors, because the data sources used to estimate utilization and cost of health care services often do not include information on behavioral health visits. Additionally, experts noted that the cost of behavioral health care services used by

[39]Authors of the studies using these data also noted limitations to these data beyond just age, such as the data being restricted to injuries occurring at work and not being specific to injuries from firearms.

[40]Experts noted that there are some options to track individuals that switch between types of health insurance, but the databases are not nationally representative. For example, experts noted that some states have all payer claims databases—databases that include claims information collected from all public and private payers in the state.

[41]Diagnosis codes are used by health care providers to uniformly describe a patient's medical condition for billing and claims reimbursement.

community members affected by firearm injuries, while important to capture for a comprehensive cost estimate, can be difficult to quantify.

- **Funding challenges.** Experts said that obtaining funding for research on firearm injuries can be challenging because this area of research has historically been underfunded.[42] Experts noted that funding challenges might partly stem from the fact that there is not a centralized institute for trauma research in the federal government.

While acknowledging that these challenges could present obstacles, economic experts highlighted possible ways to obtain more comprehensive information on the post-discharge costs of firearm injuries.

- **Pre-post studies.** Experts mentioned that the study discussed above examining changes to private health care insurance payments before and after a firearm injury could be a good model for further research. One expert noted that the approach is commonly used to estimate the cost of other injuries, but had thus far not been widely used in firearm injury research. To build on this study, another expert suggested the time frame of the study could be expanded or the study could use data from different insurers to estimate costs.
- **Broader injury research.** Experts said that broader injury research, while not specific to firearm injuries, could provide insight on their health care costs. In particular, experts noted that there are national databases that collect longitudinal data on patients with spinal cord injuries and traumatic brain injuries, which have been used by various

[42]A restriction enacted as part of the CDC's annual appropriation for fiscal year 1997, commonly known as the Dickey Amendment, provided that "none of the funds made available for injury prevention and control at the [CDC] may be used to advocate or promote gun control." Pub. L. No. 104-208, 110 Stat. 3009, 3009-244 (1996). The provision has been included in subsequent appropriations acts, with the scope extended to cover all agencies within the Department of Health and Human Services beginning in fiscal year 2012. Pub. L. No. 112-74, § 218, 125 Stat. 786, 1085 (2011). Some agencies have cited the provision, which specifically restricts the advocacy or promotion of gun control, as the reason for historically limited federal funding for firearm injury research.

For fiscal year 2020, Congress appropriated $12.5 million each to CDC and the National Institutes of Health to award grants related to firearm injury and mortality prevention research. See Explanatory Statement, 165 Cong. Rec. H11067, H11072 (daily ed. Dec. 19, 2019) (statement of Rep. Lowey); Pub. L. No. 116-94, § 4, 133 Stat. 2534, 2536 (2019) (clarifying that the explanatory statement regarding this act shall have the same effect as a joint explanatory statement with respect to the allocation of funds and implementation of certain divisions). For fiscal year 2021, Congress also appropriated $12.5 million each to CDC and the National Institutes of Health for this purpose.

studies to estimate the costs of lifelong care for these injuries.[43] For example, one such study found that health care costs averaged around $220,000 within the first year after hospital discharge for a spinal cord injury, and around $70,000 each year thereafter.[44]

- **Updating lifetime cost estimates.** One expert mentioned that it might be possible to estimate long-term costs similar to those estimated by previous studies with workers' compensation data using current data sources, such as Medicaid, Medicare, or private insurance claims. However, the expert noted that this analysis would require sophisticated modeling in order to produce reliable cost estimates.

Agency Comments

We provided a draft of this report to the Department of Health and Human Services for comment. The department provided technical comments, which we incorporated as appropriate.

As agreed with your offices, unless you publically announce the contents of this report earlier, we plan no further distribution until 30 days from the report date. At that time, we will send copies to the Secretary of the Department of Health and Human Services and other interested parties. In addition, the report will be available at no charge on the GAO website at http://www.gao.gov.

[43]The Spinal Cord Injury Model Systems Data Center and the Traumatic Brain Injury Model Systems National Data and Statistical Center are sponsored by the National Institute on Disability, Independent Living, and Rehabilitation Research, which is part of the Department of Health and Human Services' Administration on Community Living.

[44]See DeVivo et al., "Costs of Care Following Spinal Cord Injury," *Topics in Spinal Cord Injury Rehabilitation*, vol. 16, no. 4 (2011): p.1-9. The estimates in this study were based on data from 2000 to 2006 and inflation adjusted to 2009 dollars. This study found that rehabilitation services drove costs in the first year after injury, while the costs of personal care attendants had the largest effect thereafter. While costs for spinal cord injuries can be significant, the frequency with which they occur among the overall population of firearm injury survivors is low.

If you or your staff have any questions about this report, please contact me at (202) 512-7114 or yocomc@gao.gov. Contact points for our Offices of Congressional Relations and Public Affairs may be found on the last page of this report. GAO staff who made key contributions to this report are listed in appendix IV.

Carolyn L. Yocom
Director, Health Care

Appendix I: Methodology for Estimating Prevalence and Costs of Initial Hospital Care for Firearm Injuries and Detailed Estimates

Methodology for Estimating Prevalence and Costs

To describe the initial hospital costs of firearm injuries in the United States, including the costs to public payers, we analyzed hospital discharge data from the Agency for Healthcare Research and Quality's (AHRQ) Healthcare Cost and Utilization Project.[1] We combined data from 2016 and 2017—the most recent years of data available at the time of our analysis—and our estimates were based on the 2 years of pooled data. We identified two distinct types of patients that may need initial hospital care for firearm injuries: those who receive treatment only in the emergency department (ED) (i.e., discharged without admission to the same or different hospital), and those who are admitted for an inpatient stay, whether through an ED or directly. We used data from AHRQ's Nationwide Emergency Department Sample to estimate the prevalence and costs of ED-only visits, and AHRQ's National Inpatient Sample to estimate the prevalence and costs of inpatient stays.[2] To identify a universe of initial ED-only visits and inpatient stays for firearm injuries in these databases, we used methods outlined by AHRQ.[3] We also used ratios developed by AHRQ to convert charges—which are included in discharge records—into costs, because charges are often much higher

[1]AHRQ is the primary federal agency collecting hospital administrative data. The Healthcare Cost and Utilization Project is a family of health care databases and related software tools representing the data collection efforts of state data organizations, hospital associations, private data organizations, and the federal government. The project began in 1988 and includes the largest collection of longitudinal hospital care data in the United States.

[2]The Nationwide Emergency Department Sample is an all-payer ED health care database that includes a 20-percent stratified sample of all U.S. hospital-owned EDs. The National Inpatient Sample is an all-payer inpatient health care database that includes a 20 percent stratified sample of all U.S. community hospital inpatient discharge records. In 2016 and 2017, the ED database was based on data from 40 states and the inpatient database on data from 49 states. Both databases reflect encounters, and thus, patients could be represented more than once if they had more than one initial encounter for a firearm injury in the 2-year period we studied.

ED-only visits were defined as any records with the following ED discharge dispositions: routine; home health care; other transfers, including skilled nursing facility, intermediate care, and another type of facility; against medical advice; discharged/transferred to court/law enforcement; not admitted to this hospital, discharged alive, destination unknown (but not admitted); and died in ED. We excluded records in the ED sample that went on to have inpatient stays, specifically; records with the disposition of transfer to short-term hospital; and admitted as an inpatient to this hospital were excluded.

[3]Specifically, we used AHRQ's Clinical Classifications Software Refined external cause code EXT005: firearm, initial encounter. This software aggregates individual diagnosis codes into a manageable number of clinically meaningful categories and is consistent with CDC injury-classification schemes. See Agency for Healthcare Research and Quality, *HCUP User Guide: Clinical Classifications Software Refined (CCSR) for ICD-10-CM Diagnoses,* CCSR-v2020.3 (May 2020).

than actual hospital costs.[4] Costs estimated from these ratios represent the costs incurred by hospitals for providing services—not payments actually received—and were inflation-adjusted to 2017 dollars in order to present costs in constant dollars over the 2-year period.[5]

We examined the prevalence and costs of initial hospital care for firearm injuries by a number of variables, including expected payer, injury site and severity, and hospital discharge status.[6] To categorize injuries by site (i.e., body region) and severity level, we used mapping tables from the Association for the Advancement of Automotive Medicine, which categorize diagnosis codes within a discharge record by body region and severity.[7] We also used the tables to calculate an overall injury severity score based on the three regions (from a total of six regions) with the

[4]Charges are the amount hospitals bill payers for a service, and they are often more than the input costs of producing the related care, such as wages, supplies, and utility costs.

AHRQ's cost-to-charge ratios are specific to each hospital, as well as each year, and derived from all-payer costs reported in facility cost reports collected by the Centers for Medicare & Medicaid Services. AHRQ develops separate ratios for inpatient care and ED treatment. While inpatient cost-to-charge ratios have historically been available, AHRQ was in the process of finalizing its first ED cost-to-charge ratios at the time of our analysis. The agency provided us with ratios that were final—37 out of 40 states—for 2016 and 2017. For the three states where these ratios were not finalized, we used data from the remaining states to impute cost-to-charge ratios based on cost-to-charge averages within five stratifying variables (census region, trauma center designation, urban/rural, ownership, and teaching status).

[5]To adjust costs for inflation, we used the Personal Health Care Expenditure component of the National Health Expenditure Accounts per AHRQ's recommendation.

[6]Health Care Cost and Utilization Project databases are billing databases and as such, include information on expected, not actual payers. According to AHRQ officials, expected payer and actual payer are closely aligned, though there can be some exceptions, for example, due to state coding practices. For more information, see the following AHRQ report and associated user guides: Barrett M, Lopez-Gonzalez L, Hines A, Andrews R, Jiang J., *An Examination of Expected Payer Coding in HCUP Databases*, HCUP Methods Series Report # 2014-03, accessed April 29, 2021, http://www.hcup-us.ahrq.gov/reports/methods/methods.jsp.

Records include information on expected primary payer and sometimes expected secondary or tertiary expected payers. Our analysis was based on expected primary payer.

[7]The body regions identified through the mapping tables were head/neck; face; chest; abdominal (and pelvic contents); extremities (and pelvic girdle); and external (i.e., if the injury that did not penetrate underlying structures, such as internal organs, blood vessels, or bones). In addition, we created a multiple sites category for injuries in a single record that occurred across more than one body region, outside of the external region, which we only counted when it was the only region in a record.

most severe injuries.[8] We did not examine firearm injury costs and prevalence by intent of injury or firearm type used due to data reliability issues.[9]

We also examined prevalence and costs by various patient demographic characteristics, including sex, age, and race, and by the geographic region of the country where care was provided. We compared these results to distributions in the U. S. population using data from the U.S. Census Bureau. Specifically, we used 2016 and 2017 census data from the Population Estimates Program and the American Community Survey.[10]

Because AHRQ's data are a sample of inpatient and ED-only discharge records, we applied survey weights provided by AHRQ for each year to create national estimates for the entire U.S. population. As such, we calculated standard errors and then relative standard errors for our

[8]Injury severity scores range from 1 to 75. We chose to categorize severity based on categories used by the American College of Surgeons in its National Trauma Databank annual reports: 1-8 for minor injuries, 9-15 for moderate, 16-24 for severe, and 25-75 for very severe injuries. In addition to the mapping tables, the Association for the Advancement of Automotive Medicine produces the abbreviated injury scale upon which injury severity scores are based. See Association for the Advancement of Automotive Medicine, *The Abbreviated Injury Scale (AIS) ICD-ISS Map v.1.1*. (Chicago, Ill.: Association for the Advancement of Automotive Medicine); 2016. See also, Loftis, KL et al., "Development of An Expert Based ICD-9-CM and ICD-10-CM Map to AIS 2005 update 2008." *Traffic Inj Prev*., vol.17 no.1 (2016): p.1-5; and Glerum KM and Zonfrillo MR, "Validation of An ICD-9-CM and ICD-10-CM Map to AIS 2005 Update 2008," *Inj Prev*., vol.25, no. 2 (2019): p. 90-92.

[9]For example, reports from a recent expert panel found that because databases in the Healthcare Cost and Utilization Project relied on the accuracy of medical coding, they may not accurately reflect these variables. The report noted that coding guidelines from the Centers for Medicare & Medicaid Services call for coders to default to accident when intent is not stated, which results in overestimation of accidental shootings and underestimation of assaults. Also, while there are separate diagnoses codes for handguns and long guns, these are often not noted in the record and instead coded as unspecified firearm type. See NORC at the University of Chicago, *The State of Firearms Data in 2019: First Report of the Expert Panel on Firearms Data Infrastructure* (Chicago, Ill.: January 2020); and NORC at the University of Chicago, *A Blueprint for a U.S. Firearms Data Infrastructure: Final Recommendations of the Expert Panel* (Chicago, Ill.: October 2020).

[10]The American Community Survey is an ongoing, annual survey of the social, economic, housing, and demographic characteristics of the nation's population. In between each census, the Population Estimates Program produces annual estimates of the population and housing units for the United States, and is based on administrative rather than survey data.

estimates.[11] (See tables 2-10.) We also conducted statistical tests of comparisons at the 95 percent confidence level or above. To assess the reliability of the data and related programs that we used, we interviewed relevant officials, reviewed related documentation, compared our estimates with prior literature, and performed electronic testing to identify missing data and obvious errors.[12] On the basis of these steps, we determined that the data were sufficiently reliable for the purposes of our reporting objectives. However, the following were not included in our analysis and should be noted when considering our estimates of initial hospital costs of firearm injuries:

- **Physician costs.** The costs of physicians providing care to patients in hospitals, referred to as professional fees, are not typically captured in hospital discharge data, including data we used from AHRQ.[13] Ratios developed by staff at the Centers for Disease Control and Prevention (CDC) suggest that including professional fees could increase costs in our estimates by around 20 percent.[14]
- **Ambulance transportation costs.** In addition to professional fees, the cost of ambulance transportation—which may or may not be provided by the receiving hospital—is also not typically captured in discharge data. In 2012, we reported on ambulance transportation

[11]Relative standard error is the standard error divided by the estimate itself. According to AHRQ, estimates with a relative standard error of 30 percent or more do not have reliable precision.

[12]Missing observations were dropped from our analysis except for body region where a category of none was included to calculate injury severity scores. Most variables had one percent or less of observations missing for firearm injury patients in both the Nationwide Emergency Department Sample and National Inpatient Sample data. Variables that had missing observations 5 percent or higher are noted where applicable.

[13]Costs that can be estimated from discharge data are facility fees, which hospitals charge payers to cover most items related to hospital care, such as the costs of equipment, room and board, or non-physician staff. Professional fees are charged separately and cover hospital services provided by physicians and other skilled health care professionals licensed for independent practice.

[14]See Cora Peterson et al., "Professional Fee Ratios for US Hospital Discharge Data," *Medical Care,* vol. 53, no. 10 (2015): p. 840-849. The ratios—defined as total payments divided by facility-only payments—were developed using ICD-9 health insurance claims data from 2012 and earlier, and, because our analysis was based on ICD-10 hospital cost data from 2016 and 2017, we did not incorporate them into our dataset. However, to get a sense of magnitude, we applied the article's 2012 adjusted mean payment ratios specific to payer and setting of care (ED-only and inpatient stays) to our annual cost totals. CDC officials said that staff are planning to update these ratios, and that the analysis would likely be completed in late 2021 or early 2022.

costs, and found that they ranged widely, but the median cost was $429 per transport.[15]

- **Federal hospital costs.** While community hospitals make up the majority of short-term, acute care hospitals in the United States, AHRQ's data does not include the costs for firearm injuries initially treated in other hospitals, namely federal hospitals run by the Department of Defense, the Department of Veterans Affairs, and the Indian Health Service. According to the American Hospital Association, in 2019, there were about 5,000 community hospitals in the United States compared with about 200 federal hospitals.[16]
- **Certain ED costs.** Information needed to estimate costs for ED care was not available for some visits, and thus our analysis underestimates costs for ED care. For example, information on hospital charges was missing for 10 percent of ED-only visits for firearm injuries, and we did not assign any costs for these visits in our estimates. Additionally, because we used the National Inpatient Sample for inpatient stays, we excluded visits in the Nationwide Emergency Department Sample when patients were admitted to a hospital, including the $44 million in ED costs for these patients. While ED costs for patients admitted to the same hospital where they had ED care are likely included in the National Inpatient Sample, and therefore in our estimates, about $15 million in ED costs for patients admitted to a different hospital are not included.

Estimates of Prevalence and Costs

The tables below present 2-year totals for the estimated prevalence and costs of initial hospital care for firearm injuries in the United States from 2016 through 2017. The tables also include the relative standard error for each estimate, which is the standard error divided by the estimate itself. Total rows will not match across tables due to differences in the number of missing observations for variables.

[15]See GAO, *Ambulance Providers: Costs and Medicare Margins Varied Widely; Transports of Beneficiaries Have Increased*, GAO-13-6 (Washington, D.C.: Oct. 1, 2012).

[16]For more information, see American Hospital Association, *Fast Facts on U.S. Hospitals 2021,* accessed April 16, 2021, https://www.aha.org/statistics/fast-facts-us-hospitals.

Table 2: Prevalence and Costs of Initial Hospital Care for Firearm Injuries in the United States, by Body Region, 2016 – 2017

	ED-only (relative standard error)			Inpatient Stays (relative standard error)		
Body region	**Total count**	**Total cost (dollars)**	**Average cost (dollars)**	**Total count**	**Total cost (dollars)**	**Average cost (dollars)**
Head and neck	2,169 (7)	4,002,965 (9)	1,846 (6)	4,965 (5)	157,489,443 (7)	31,720 (5)
Chest	2,279 (12)	5,733,858 (11)	2,516 (7)	4,495 (5)	110,855,564 (6)	24,662 (4)
Abdominal	1,533 (9)	6,959,369 (12)	4,539 (8)	7,065 (5)	256,247,682 (6)	36,270 (4)
Extremities	18,563 (6)	31,612,511 (9)	1,703 (5)	21,390 (5)	397,134,237 (6)	18,566 (2)
Face	1,870 (7)	3,204,401 (13)	1,714 (9)	1,835 (6)	51,665,189 (8)	28,155 (5)
External[a]	71,065 (5)	90,193,082 (8)	1,269 (4)	6,270 (4)	63,430,263 (6)	10,116 (4)
Multiple regions[b]	1,639 (10)	7,228,307 (13)	4,409 (8)	18,555 (5)	963,856,866 (6)	51,946 (3)
Unspecified[c]	3,321 (6)	2,490,423 (11)	750 (8)	975 (7)	11,935,911 (13)	12,242 (10)
Total	**102,439 (5)**	**151,424,915 (8)**	**1,478 (4)**	**65,550 (4)**	**2,012,615,155 (5)**	**30,703 (2)**

Source: GAO analysis of Agency for Healthcare Research and Quality's Healthcare Cost and Utilization Project Nationwide Emergency Department Sample and National Inpatient Sample data. | GAO-21-515

Notes: Relative standard error is the standard error divided by the estimate itself. According to the Agency for Healthcare Research and Quality, estimates with a relative standard error of 30 percent or more do not have reliable precision.

Estimates presented are 2-year totals based on pooled data from 2016 and 2017. Costs were inflation-adjusted to 2017 dollars and represent the costs to hospitals for providing services. The estimates do not account for non-facility costs, such as professional fees, or for care at non-community hospitals, such as federal hospitals run by the Department of Veterans Affairs, the Department of Defense, or Indian Health Service. Individual cost estimates may not add to the total estimated cost due to rounding.

Emergency department (ED) only visits are those where the patient was discharged without an inpatient stay (i.e., the patient was not admitted to the same hospital or transferred to a different hospital). Ten percent of ED-only visits were excluded from our analysis due to missing cost information.

[a]External injuries are those that affected the skin, but did not injure any underlying body structures, such as internal organs, blood vessels, or bones.

[b]Multiple regions are injuries affecting more than one body region other than the external region, which we did not count when populating this category.

[c]Unspecified are injuries that could not be categorized by body region.

Table 3: Prevalence and Costs of Initial Hospital Care for Firearm Injuries in the United States, by Injury Severity, 2016 – 2017

	ED-only (relative standard error)			Inpatient stays (relative standard error)		
Injury severity[a]	Total count	Total cost (dollars)	Average cost (dollars)	Total count	Total cost (dollars)	Average cost (dollars)
1 – 8	92,371 (5)	126,848,878 (8)	1,373 (4)	25,290 (4)	456,779,273 (5)	18,062 (2)
9 – 15	4,805 (10)	15,155,092 (11)	3,154 (6)	26,780 (5)	798,237,879 (5)	29,807 (2)
16 – 24	330 (17)	2,506,629 (21)	7,597 (10)	4,175 (6)	247,855,339 (8)	59,367 (4)
25 – 75	580 (12)	3,479,807 (18)	5,997 (13)	8,200 (5)	495,787,070(6)	60,462 (3)
Total	**98,086 (5)**	**147,990,407 (8)**	**1,509 (4)**	**64,445 (4)**	**1,998,659,562 (5)**	**31,013 (2)**

Source: GAO analysis of Agency for Healthcare Research and Quality's Healthcare Cost and Utilization Project Nationwide Emergency Department Sample and National Inpatient Sample data. | GAO-21-515

Notes: Relative standard error is the standard error divided by the estimate itself. According to the Agency for Healthcare Research and Quality, estimates with a relative standard error of 30 percent or more do not have reliable precision.

Estimates presented are 2-year totals based on pooled data from 2016 and 2017. Costs were inflation-adjusted to 2017 dollars and represent the costs to hospitals for providing services. The estimates do not account for non-facility costs, such as professional fees, or for care at non-community hospitals, such as federal hospitals run by the Department of Veterans Affairs, the Department of Defense, or Indian Health Service. Individual cost estimates may not add to the total estimated cost due to rounding.

Emergency department (ED) only visits are those where the patient was discharged without an inpatient stay (i.e., the patient was not admitted to the same hospital or transferred to a different hospital). Ten percent of ED-only visits were excluded from our analysis due to missing cost information.

[a]Injury severity was categorized based on the categories used by the American College of Surgeons in its National Trauma Databank annual reports: 1-8 for minor injuries, 9-15 for moderate, 16-24 for severe, and 25-75 for very severe injuries.

Table 4: Prevalence and Costs of Initial Hospital Care for Firearm Injuries in the United States, by Discharge Status, 2016 – 2017

	ED-only (relative standard error)			Inpatient stays (relative standard error)		
Discharge Status	Total count	Total cost (dollars)	Average cost (dollars)	Total count	Total cost (dollars)	Average cost (dollars)
Routine[a]	87,508 (5)	116,617,870 (8)	1,333 (4)	44,650 (5)	1,050,039,438 (6)	23,517 (2)
Died	10,579 (8)	28,604,408 (11)	2,704 (6)	5,550 (5)	168,121,538 (7)	30,292 (4)
Transfer to another acute care hospital	n/a	n/a	n/a	1,575 (7)	69,474,963 (10)	44,111 (7)
Further care[b]	2,228 (8)	3,129,355 (9)	1,404 (5)	12,420 (4)	696,666,413 (5)	56,092 (3)
Other[c]	2,123 (9)	3,073,283 (11)	1,447 (6)	1,265 (7)	24,867,158 (10)	19,658 (7)
Total	**102,439 (5)**	**151,424,915 (8)**	**1,478 (4)**	**65,460 (4)**	**2,009,169,510 (5)**	**30,693 (2)**

Source: GAO analysis of Agency for Healthcare Research and Quality's Healthcare Cost and Utilization Project Nationwide Emergency Department Sample and National Inpatient Sample data. | GAO-21-515

Notes: Relative standard error is the standard error divided by the estimate itself. According to the Agency for Healthcare Research and Quality, estimates with a relative standard error of 30 percent or more do not have reliable precision.

Estimates presented are 2-year totals based on pooled data from 2016 and 2017. Costs were inflation-adjusted to 2017 dollars and represent the costs to hospitals for providing services. The estimates do not account for non-facility costs, such as professional fees, or for care at non-community hospitals, such as federal hospitals run by the Department of Veterans Affairs, the Department of Defense, or Indian Health Service. Individual cost estimates may not add to the total estimated cost due to rounding.

Emergency department (ED)-only visits are those where the patient was discharged without an inpatient stay (i.e., the patient was not admitted to the same hospital or transferred to a different hospital). Ten percent of ED-only visits were excluded from our analysis due to missing cost information.

n/a = not applicable

[a]Routine discharges are those where patients are discharged to self-care at home.

[b]Discharges to further care are those where patients are transferred to a facility that is not a short-term hospital, such as a skilled nursing facility, or are prescribed home health care.

[c]Other discharges include those where patients left against medical advice or where discharge destination was unknown.

Table 5: Prevalence and Costs of Initial Hospital Care for Firearm Injuries in the United States, by Expected Payer, 2016 – 2017

	ED-only (relative standard error)			Inpatient stays (relative standard error)		
Payer	**Total count**	**Total cost (dollars)**	**Average cost (dollars)**	**Total count**	**Total cost (dollars)**	**Average cost (dollars)**
Medicare	5,640 (5)	7,084,464 (7)	1,256 (5)	4,160 (5)	120,630,135 (7)	28,998 (5)
Medicaid	29,840 (7)	45,437,105 (10)	1,523 (4)	28,925 (5)	1,037,295,434 (5)	35,862 (2)
Private	22,668 (6)	30,222,334 (8)	1,333 (5)	13,185 (4)	384,907,004 (6)	29,193 (3)
Self-pay	36,251 (7)	55,917,559 (11)	1,543 (6)	13,180 (7)	299,651,925 (9)	22,735 (3)
No charge[a]	1,140 (29)	1,933,311 (31)	1,697 (10)	1,135 (15)	25,950,343 (18)	22,864 (9)
Other public payers[b]	6,558 (13)	10,335,433 (19)	1,576 (11)	4,670 (10)	138,710,679 (12)	29,702 (5)
Total	**102,096 (5)**	**150,930,206 (8)**	**1,478 (4)**	**65,255 (4)**	**2,007,145,519 (5)**	**30,758 (2)**

Source: GAO analysis of Agency for Healthcare Research and Quality's (AHRQ) Healthcare Cost and Utilization Project Nationwide Emergency Department Sample and National Inpatient Sample data. | GAO-21-515

Notes: Relative standard error is the standard error divided by the estimate itself. According to AHRQ, estimates with a relative standard error of 30 percent or more do not have reliable precision; thus, the no charge estimate for ED-only total costs should be interpreted with caution.

Estimates presented are 2-year totals based on pooled data from 2016 and 2017. Costs were inflation-adjusted to 2017 dollars and represent the costs to hospitals for providing services, not what payers paid. The estimates do not account for non-facility costs, such as professional fees, or for care at non-community hospitals, such as federal hospitals run by the Department of Veterans Affairs, the Department of Defense, or Indian Health Service. Individual cost estimates may not add to the total estimated cost due to rounding.

Expected payer is the primary payer billed for services rendered. According to AHRQ officials, expected payer and actual payer are generally closely aligned.

Emergency department (ED) only visits are those where the patient was discharged without an inpatient stay (i.e., the patient was not admitted to the same hospital or transferred to a different hospital). Ten percent of ED-only visits were excluded from our analysis due to missing cost information.

[a]No charge refers to records where the hospital does not plan to charge the patient or another payer for care provided.

[b]Other public payers includes health benefits provided through the Department of Defense, the Department of Veterans Affairs, and other government programs.

Table 6: Prevalence and Costs of Initial Hospital Care for Firearm Injuries in the United States, by Sex, 2016 – 2017

	ED-only (relative standard error)			Inpatient stays (relative standard error)		
Sex	**Total count**	**Total cost (dollars)**	**Average cost (dollars)**	**Total count**	**Total cost (dollars)**	**Average cost (dollars)**
Male	88,701 (5)	132,112,916 (8)	1,489 (4)	57,775 (4)	1,792,471,189 (5)	31,025 (2)
Female	13,619 (6)	18,944,127 (9)	1,391 (5)	7,740 (5)	219,558,061 (6)	28,367 (4)
Total	**102,321 (5)**	**151,057,042 (8)**	**1,476 (4)**	**65,515 (4)**	**2,012,029,250 (5)**	**30,711 (2)**

Source: GAO analysis of Agency for Healthcare Research and Quality's Healthcare Cost and Utilization Project Nationwide Emergency Department Sample and National Inpatient Sample data. | GAO-21-515

Notes: Relative standard error is the standard error divided by the estimate itself. According to the Agency for Healthcare Research and Quality, estimates with a relative standard error of 30 percent or more do not have reliable precision.

Estimates presented are 2-year totals based on pooled data from 2016 and 2017. Costs were inflation-adjusted to 2017 dollars and represent the costs to hospitals for providing services. The estimates do not account for non-facility costs, such as professional fees, or for care at non-community hospitals, such as federal hospitals run by the Department of Veterans Affairs, the Department of Defense, or Indian Health Service. Individual cost estimates may not add to the total estimated cost due to rounding.

Emergency department (ED) only visits are those where the patient was discharged without an inpatient stay (i.e., the patient was not admitted to the same hospital or transferred to a different hospital). Ten percent of ED-only visits were excluded from our analysis due to missing cost information.

Table 7: Prevalence and Costs of Initial Hospital Care for Firearm Injuries in the United States, by Age, 2016 – 2017

	ED-only (relative standard error)			Inpatient stays (relative standard error)		
Age group	**Total count**	**Total cost (dollars)**	**Average cost (dollars)**	**Total count**	**Total cost (dollars)**	**Average cost (dollars)**
0 to 14	2,839 (8)	3,449,423 (15)	1,215 (10)	1,365 (8)	47,490,063 (13)	34,791 (9)
15 to 29	55,925 (6)	81,722,386 (8)	1,461 (4)	35,165 (5)	1,020,524,764 (5)	29,021 (2)
30 to 44	26,196 (6)	41,930,403 (9)	1,601 (5)	17,450 (5)	583,944,295 (6)	33,464 (3)
45 to 59	11,180 (5)	15,421,493 (8)	1,379 (5)	7,860 (5)	257,410,160 (7)	32,749 (4)
65 and over	6,223 (5)	8,731,978 (11)	1,403 (7)	3,690 (5)	102,584,826 (7)	27,801 (5)
Total	**102,363 (5)**	**151,255,683 (8)**	**1,478 (4)**	**65,530 (4)**	**2,011,954,107 (5)**	**30,703 (2)**

Source: GAO analysis of Agency for Healthcare Research and Quality's Healthcare Cost and Utilization Project Nationwide Emergency Department Sample and National Inpatient Sample data. | GAO-21-515

Notes: Relative standard error is the standard error divided by the estimate itself. According to the Agency for Healthcare Research and Quality, estimates with a relative standard error of 30 percent or more do not have reliable precision.

Estimates presented are 2-year totals based on pooled data from 2016 and 2017. Costs were inflation-adjusted to 2017 dollars and represent the costs to hospitals for providing services. The estimates do not account for non-facility costs, such as professional fees, or for care at non-community hospitals, such as federal hospitals run by the Department of Veterans Affairs, the Department of Defense, or Indian Health Service.

Emergency department (ED) only visits are those where the patient was discharged without an inpatient stay (i.e., the patient was not admitted to the same hospital or transferred to a different hospital). Ten percent of ED-only visits were excluded from our analysis due to missing cost information.

Table 8: Prevalence and Costs of Initial Hospital Care for Firearm Injuries in the United States, by Race and Ethnicity, 2016 – 2017

	Inpatient stays (relative standard error)		
Race and ethnicity	**Total count**	**Total cost (dollars)**	**Average cost (dollars)**
White	17,885 (4)	515,704,093 (5)	28,834 (3)
Black	32,085 (6)	953,106,926 (7)	29,706 (2)
Hispanic	8,980 (6)	317,323,128(8)	35,337 (4)
Other	3,205 (8)	109,465,479 (10)	34,155 (6)
Total	**62,155 (4)**	**1,895,599,627 (5)**	**30,498 (2)**

Source: GAO analysis of Agency for Healthcare Research and Quality's (AHRQ) Healthcare Cost and Utilization Project National Inpatient Sample data. | GAO-21-515

Notes: Relative standard error is the standard error divided by the estimate itself. According to AHRQ, estimates with a relative standard error of 30 percent or more do not have reliable precision.

Estimates presented are 2-year totals based on pooled data from 2016 and 2017. Costs were inflation-adjusted to 2017 dollars and represent the costs to hospitals for providing services. The estimates do not account for non-facility costs, such as professional fees, or for care at non-community hospitals, such as federal hospitals run by the Department of Veterans Affairs, the Department of Defense, or Indian Health Service.

We reported race and ethnicity according to the classification in AHRQ's National Inpatient Sample. Because of small sample sizes of Asian and Pacific Islanders, Native Americans, and others, we combined these groups and included them in other. While only 5 percent of observations were missing for race and ethnicity, according to AHRQ officials, these values are systematically missing from certain states and certain hospitals.

Table 9: Prevalence and Costs of Initial Hospital Care for Firearm Injuries in the United States, by Median Household Income Quartile, 2016 – 2017

	ED-only (relative standard error)			Inpatient stays (relative standard error)		
Median household income	**Total count**	**Total cost (dollars)**	**Average cost (dollars)**	**Total count**	**Total cost (dollars)**	**Average cost (dollars)**
First quartile	56,654 (7)	84,895,900 (10)	1,499 (5)	34,175 (5)	1,011,128,156 (6)	29,587 (2)
Second quartile	21,540 (6)	29,915,917 (9)	1,389 (5)	14,290 (5)	439,461,027 (6)	30,753 (3)
Third quartile	15,067 (6)	22,627,014 (8)	1,502 (4)	10,295 (5)	314,127,065 (6)	30,513 (3)
Fourth quartile	7,044 (6)	10,035,793 (8)	1,425 (5)	5,250 (5)	193,841,971 (9)	36,922 (6)
Total	**100,304 (5)**	**147,474,624 (8)**	**1,470 (4)**	**64,010 (4)**	**1,958,558,219 (5)**	**30,598 (2)**

Source: GAO analysis of Agency for Healthcare Research and Quality's Healthcare Cost and Utilization Project Nationwide Emergency Department Sample and National Inpatient Sample data. | GAO-21-515

Notes: Relative standard error is the standard error divided by the estimate itself. According to the Agency for Healthcare Research and Quality, estimates with a relative standard error of 30 percent or more do not have reliable precision.

Estimates presented are 2-year totals based on pooled data from 2016 and 2017. Costs were inflation-adjusted to 2017 dollars and represent the costs to hospitals for providing services. The

estimates do not account for non-facility costs, such as professional fees, or for care at non-community hospitals, such as federal hospitals run by the Department of Veterans Affairs, the Department of Defense, or Indian Health Service. Individual cost estimates may not add to the total estimated cost due to rounding.

Median household income was based on the annual median household income for a patient's zip code. For 2016, the median income quartiles were defined (in order from 1st through 4th) as $1–$42,999; $43,000– $53,999; $54,000–$70,999; and $71,000 or more: For 2017, they were: $1–$43,999; $44,000– $55,999; $56,000–$73,999; and $74,000 or more.

Emergency department (ED) only visits are those where the patient was discharged without an inpatient stay (i.e., the patient was not admitted to the same hospital or transferred to a different hospital). Ten percent of ED-only visits were excluded from our analysis due to missing cost information.

Table 10: Prevalence and Costs of Initial Hospital Care for Firearm Injuries in the United States, by Region of the Country, 2016 – 2017

	Inpatient stays (relative standard error)		
Region of the country	**Total count**	**Total cost (dollars)**	**Average cost (dollars)**
Northeast	7,710 (9)	228,397,365 (11)	29,624 (5)
Midwest	13,200 (10)	367,180,837 (10)	27,817 (3)
South	31,680 (7)	892,609,692 (9)	28,176 (3)
West	12,960 (7)	524,427,260 (8)	40,465 (3)
Total	**65,550 (4)**	**2,012,615,155 (5)**	**30,703 (2)**

Source: GAO analysis of Agency for Healthcare Research and Quality's Healthcare Cost and Utilization Project Nationwide Emergency Department Sample and National Inpatient Sample data. | GAO-21-515

Notes: Relative standard error is the standard error divided by the estimate itself. According to the Agency for Healthcare Research and Quality, estimates with a relative standard error of 30 percent or more do not have reliable precision.

Estimates presented are 2-year totals based on pooled data from 2016 and 2017. Costs were inflation-adjusted to 2017 dollars and represent the costs to hospitals for providing services. The estimates do not account for non-facility costs, such as professional fees, or for care at non-community hospitals, such as federal hospitals run by the Department of Veterans Affairs, the Department of Defense, or Indian Health Service. Individual cost estimates may not add to the total estimated cost due to rounding.

Regions presented are based on regional designations from the U.S. Census Bureau. We did not report on emergency department (ED) only distributions by region, because missing ED cost information was concentrated in the Western region of the country. However, before missing costs were dropped from our analysis, regional prevalence distributions were similar for inpatient and ED care.

Appendix II: Expert Panels on Health Care Service Use and Costs for Firearm Injuries after Hospital Discharge

We convened two expert panels, one to discuss post-discharge physical and behavioral health care service needs for firearm injuries and the other to discuss what is known about the cost of this care. To select participants for our panels, we contracted with the National Academies of Sciences, Engineering, and Medicine (National Academies) to help identify potential participants. The National Academies identified potential experts based on the experts' experience in the following areas:

- Treating firearm injuries in the emergency department or upon admission to the hospital, such as trauma surgeons or nurses.
- Treating firearm injuries outside of the hospital, such as rehabilitation specialists or behavioral health professionals.
- Examining health care service use and costs associated with firearm injuries and other relevant injuries or conditions, such as health economists.

From the list of potential experts from the National Academies, we selected participants who represented these areas of expertise, along with considering their depth and range of experience and geographic focus, among other things. Before finalizing the participation of experts, we evaluated them for possible conflicts of interest. We considered conflicts of interest to be any current financial or other interest that might affect the objectivity of an expert's statement during the meetings. (See table 11.)

The expert panels were planned and convened with the assistance of the National Academies to better ensure that a breadth of expertise was brought to bear in its preparation; however, all final decisions regarding meeting substance and expert participation were our responsibility. Any conclusions in this report are solely ours.

Table 11: Participants in Expert Panels on Health Care Service Use and Costs for Firearm Injuries after Hospital Discharge

	Expert	Affiliation	Discipline	Relevant specialty
Clinical	Lisa Allee, M.S.W., LICSW	Boston Medical Center Boston University Medical School	Social worker	Mental health of violence survivors and families
	Stephanie Bonne, M.D., FACS	Rutgers University Hospital Rutgers New Jersey Medical School	Trauma surgeon	Firearm violence and injury prevention
	Rochelle Dicker, M.D., FACS	University of California Los Angeles Health, David Geffen School of Medicine at University of California Los Angeles	Trauma surgeon	Injury and violence prevention
	Michelle Gittler, M.D.	Schwab Rehabilitation Hospital University of Chicago Medicine	Rehabilitation physician	Violently acquired injury, spinal cord injury, and amputations
	Bindu Kalesan, Ph.D., M.P.H., MS	Boston University	Clinical epidemiologist	Health outcomes of firearm injury survivors
	Therese Richmond, Ph.D., R.N., FAAN	Perelman School of Medicine at University of Pennsylvania	Trauma nurse	Injury and violence prevention, mental health outcomes of firearm injury survivors
	Thomas Weiser, M.D., MPH	Stanford University Medical Center	Trauma surgeon	Delivery of and access to surgical care
	Ross Zafonte, D.O.	Spaulding Rehabilitation Hospital Harvard Medical School	Rehabilitation physician	Traumatic brain injury
Cost	Phillip Cook, Ph.D.	Duke University	Economist	Firearms violence
	Anne Deutsch, R.N., Ph.D., CRRN	Feinberg School of Medicine at Northwestern University Rehabilitation Institute of Chicago	Rehabilitation researcher	Spinal cord injuries
	Joseph Levy, Ph.D.	Johns Hopkins Bloomberg School of Public Health	Economist	Extremity trauma
	Ted Miller, Ph.D.	Pacific Institute for Research and Evaluations Curtin University School of Public Health	Economist	Health economics and injury prevention

Legend: M.S.W. = master of social work; LICSW = licensed independent clinical social worker; M.D. = doctor of medicine; FACS = fellow of the American College of Surgeons; Ph.D. = doctor of philosophy; M.P.H. = master of public health; MS = master of science; FAAN = fellow of the American Academy of Nursing; D.O. = doctor of osteopathy; R.N. = registered nurse; CRRN = certified rehabilitation registered nurse

Source: GAO | GAO-21-515

Appendix III: Literature Review on the Health Care Costs of Firearm Injuries after Hospital Discharge

To obtain information on what is known about the costs of care for firearm injuries after hospital discharge, we conducted a structured review of peer-reviewed literature and government reports. We searched multiple databases for studies published through December 2020 and identified 360 studies that were potentially relevant.[1] We reviewed the abstracts of each identified study and eliminated those that did not meet our criteria for inclusion.[2] As a result, we identified 16 studies to include in our review. For these studies, we reviewed their data sources, methodologies, and findings, including stated limitations. (See table 12.)

Table 12: Studies on the Health Care Costs of Firearm Injuries after Hospital Discharge, by Methodology

Methodology	Study
Estimated costs within one year of discharge	1. Kalesan, Bindu, Yi Zuo, Ramachandran S. Vasan, and Sandro Galea. "Risk of 90-Day Readmission in Patients after Firearm Injury Hospitalization: A Nationally Representative Retrospective Cohort Study." *Journal of Injury and Violence Research*, vol. 11, no. 1 (2019).
	2. Quiroz, Hallie J., Liann C. Casey, Joshua P. Parreco, Brent A. Willobee, Rishi Rattan, David S. Lasko, Eduardo A. Perez, Juan E. Sola, and Chad M. Thorson. "Human and Economic Costs of Pediatric Firearm Injury." *Journal of Pediatric Surgery*, vol. 55, no. 5 (2020).
	3. Rattan, Rishi, Joshua Parreco, Nicholas Namias, Gerd D. Pust, D. Dante Yeh, and Tanya L. Zakrison. "Hidden Costs of Hospitalization after Firearm Injury: National Analysis of Different Hospital Readmission." *Annals of Surgery*, vol. 267, no. 5 (2018).
	4. Spitzer, Sarabeth A., Daniel Vail, Lakshika Tennakoon, Charlotte Rajasingh, David A. Spain, and Thomas G. Weiser. "Readmission Risk and Costs of Firearm Injuries in the United States, 2010-2015." PLoS ONE, vol. 14, no. 1 (2019).
	5. Zuo, Yi, Elizabeth C. Pino, Mrithyunjay Vyliparambil, and Bindu Kalesan. "Sex Differences in Early Cardiovascular and All-Cause Hospitalization Outcomes after Surviving Firearm Injury." *American Journal of Men's Health*, vol. 12, no. 4 (2018).
	6. Ranney, Megan L., Curtis Herges, Leanne Metcalfe, Jeremiah D. Schuur, Paul Hain, and Ali Rowhani-Rahbar. "Increases in Actual Health Care Costs and Claims after Firearm Injury." *Annals of Internal Medicine*, vol. 173, no. 12 (2020).
Estimated lifetime costs	7. Cook, Philip J., Bruce A. Lawrence, Jens Ludwig, and Ted R. Miller. "The Medical Costs of Gunshot Injuries in the United States." *JAMA*, vol. 281, no. 5 (1999).
	8. Corso, P., E. Finkelstein, T. Miller, I. Fiebelkorn, and E. Zaloshnja. "Incidence and Lifetime Costs of Injuries in the United States." *Injury Prevention*, vol. 12, no. 4 (2006).
	9. Corso, Phaedra S., James A. Mercy, Thomas R. Simon, Eric A. Finkelstein, and Ted R. Miller. "Medical Costs and Productivity Losses Due to Interpersonal and Self-Directed Violence in the United States." *American Journal of Preventative Medicine*, vol. 32, no. 6 (2007).

[1]We performed a structured search of databases, including ProQuest, Scopus, EBSCO, and Dialog, using research terms such as firearm, gun, health, care, medical, cost, and reimbursement.

[2]We excluded studies where the research was not (1) focused on the United States; (2) empirically analytical, such as opinion pieces; and (3) reporting specific estimates of health care costs associated with firearm injuries after a patient's discharge from the hospital, such as studies whose estimates included the costs of lost productivity.

Methodology	Study
	10. Max, Wendy and Dorothy P. Rice. “Shooting in the Dark: Estimating the Cost of Firearm Injuries.” *Health Affairs*, vol. 12, no. 4 (1993).
	11. Miller, Ted R., and Mark A. Cohen. “Costs of Gunshot and Cut/Stab Wounds in the United States, with Some Canadian Comparisons.” *Accident Analysis and Prevention*, vol. 29, no. 3 (1997).
Other studies[a]	12. Chopra, Teena, Dror Marchaim, Reda A. Awali, Miriam Levine, Smitha Sathyaprakash, Indu K. Chalana, Farah Ahmed, Emily T. Martin, Mary Sieggreen, Jack D. Sobel, and Keith S. Kaye. “Risk Factors and Acute In-Hospital Costs for Infected Pressure Ulcers among Gunshot-Spinal Cord Injury Victims in Southeastern Michigan.” *American Journal of Infection Control*, vol. 44, no. 3 (2016).
	13. Evans, Parker T., Jacquelyn S. Pennings, Richard Samade, Harold N. Lovvorn III, and Jeffrey E. Martus. “The Financial Burden of Musculoskeletal Firearm Injuries in Children with and without Concomitant Intra-Cavitary Injuries.” *Journal of Pediatric Surgery*, vol. 55, no. 9 (2020).
	14. Ordog, Gary J., Jonathan Wasserberger, and Greg Ackroyd. “Hospital Costs of Firearm Injuries.” *The Journal of Trauma: Injury, Infection, and Critical Care*, vol. 38, no. 2 (1995).
	15. Smith, Winston, John O. Simmonds, Zohair S. Alam, and Richard E. Grant. “Spinal Cord Injury Caused by Gunshot Wounds: The Cost of Rehabilitation.” Clinical Orthopaedics and Related Research, no. 408 (2003).
	16. Wintemute, Garen J., and Mona A. Wright. “Initial and Subsequent Hospital Costs of Firearm Injuries.” *The Journal of Trauma*, vol. 33, no. 4 (1992).

Source: GAO | GAO-21-515.

[a]These studies did not follow patients for a specified time period (e.g., one year after discharge), but instead followed patients from their first admission to the hospital with a firearm injury within the study period through the end of the study period. We chose not to report on the details of these studies, either because they had very specific patient populations that limited generalizability for our purposes or because they relied on data from before 2000.

Appendix IV: GAO Contacts and Staff Acknowledgements

GAO contact

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Staff Acknowledgements

In addition to the contact name above, key contributors to this report were Susan Barnidge (Assistant Director), Rachel Svoboda (Analyst in Charge), Haley Klosky, Moira Lenox, and Ravi Sharma. Other contributors to this report were Giselle Hicks, Drew Long, Diona Martyn, Amanda Miller, Jeanne Murphy-Stone, Eric Peterson, Ethiene Salgado-Rodriguez, and Eric Wedum.