



State Variation in Hospital Use and Cost of Firearm Assault Injury, 2010

EMBRY HOWELL, SAM BIELER, AND NATHANIEL ANDERSON

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The consequences of gun violence differ significantly by location and social circumstances. Understanding these social and geographic variations is important in helping policymakers understand the scope of gun violence and identify sound policy solutions. This brief looks at who visits the hospital for firearm-assault injuries and what percentage of that hospital cost is borne by the public in six different states: Arizona, California, Maryland, New Jersey, North Carolina, and Wisconsin. Findings build on national estimates of firearm-assault injury prevalence and hospital cost developed by Howell and Abraham (2013).

In 2010, the total cost, including societal cost, of firearm violence was estimated at \$174 billion (Miller 2012). Though the monetary costs imposed by gun violence are large, the physical injuries are not distributed evenly: gun violence is often concentrated in a small number of places and within a small set of communities. In Boston, for example, more than half of gun violence is clustered around less than 3 percent of streets and intersections (Braga, Papachristos, and Hureau 2010), and in a Chicago community, 41 percent of gun homicides occurred in social networks containing just 4 percent of the population (Papachristos and Wildeman 2014). Youth are also disproportionately affected by gun violence. In 2010, homicide was the third-leading cause of death for youth ages 10 to 24, greater than the next seven leading causes of death combined (David-Ferdon and Simon 2014). Given these variations, documenting the distribution and hospital costs of firearm-assault injury at the state level is important for understanding the varied effects of gun violence and the costs the public pays because of it.

Highlights

- Among the six states studied, there are substantial differences in firearm-assault injury hospital use, hospital mortality, and the percentage of firearm-assault injury hospital costs borne by the public.
- Hospital use for firearm-assault injury is disproportionately concentrated among young males, particularly young black males, in all six study states.
- Uninsured victims have higher hospital mortality rates for firearm-assault injury in five of six study states.
- The public pays a substantial portion of the hospital cost for injuries caused by firearm assault. Public health insurance paid 52 percent of the cost nationally in 2010 (19 to 64 percent across the six study states). The uninsured, whose care is often paid by the public, represented 17 to 59 percent of costs.

States and Data

The study measures the prevalence of hospital use and the hospital cost of injuries caused by intentional firearm assault (not including unintentional or self-inflicted injury) in six states¹ and nationally. The six states were selected to provide regional and economic diversity (table 1) and for differences in their rates of gun crime (table 2).

TABLE 1

Key State Attributes, 2010

	Population (millions)	Below poverty line (%)	Without health insurance (%)	Black (%)	Hispanic (%)
Arizona	6.4	17.4	16.9	4.1	29.8
California	37.4	15.8	18.5	6.0	37.7
Maryland	5.8	9.9	11.3	29.4	8.2
New Jersey	8.8	10.3	13.2	13.5	17.8
North Carolina	9.6	17.5	16.8	21.4	8.4
Wisconsin	5.7	13.2	9.4	6.2	5.9

Source: American Community Survey, 2010.

TABLE 2

Crimes Committed with a Firearm per 100,000*In select states and the United States, 2010*

	Homicide	Robbery	Aggravated assault
Arizona	3.8	49.9	59.5
California	3.4	48.6	45.6
Maryland	7.0	78.4	42.3
New Jersey	2.8	45.3	24.1
North Carolina	3.5	54.7	70.3
Wisconsin	1.8	44.5	33.5
Total, United States	2.8	41.3	44.7

Source: Federal Bureau of Investigation, *Crime in the United States 2010* (Washington, DC: US Department of Justice, 2010).

The states range in population size, household income, and racial and ethnic diversity. All six states are above the national average for robbery committed with a firearm, and four states (Arizona, California, Maryland, and North Carolina) are above the national average for homicide with a firearm. New Jersey and Wisconsin are both below the national average for aggravated assault with a firearm; Arizona and North Carolina have a rate that is substantially above the national average.

To investigate state variations, this study draws on health care utilization data from the Healthcare Cost and Utilization Project. The Healthcare Cost and Utilization Project data contain information on both the diagnosis precipitating a hospital emergency department visit or inpatient stay and the cause of the injury (for example, firearm assault).² Four sources of Healthcare Cost and Utilization Project data are used in this report: the Nationwide Inpatient Sample (NIS), the Nationwide Emergency Department Sample (NEDS), the State Emergency Department Databases (SEDD), and the State Inpatient Databases (SID). NEDS and NIS data are weighted to create nationally representative estimates.

Victims of firearm assault are usually brought to a hospital emergency department where they may be treated and discharged or transferred into the inpatient section of the hospital for further treatment. Rarely, they may bypass the emergency department and be admitted directly (e.g., if they are taken directly to the operating room). NEDS and SEDD capture costs originating in emergency departments; and NIS and SID capture costs originating in inpatient sections. Together, these capture the range of hospital costs associated with a firearm assault injury.

We measure the rate of hospital use for firearm-assault injury per 100,000 people, the hospital mortality rate for firearm-assault injury, and the hospital cost of for firearm-assault injury. Firearm-assault-injury hospital use is measured by adding (1) the number of firearm-assault-injury emergency department visits that do not lead to admission to (2) the number of firearm-assault-injury hospital stays. For population denominators in rates, we use the 2010 US Census, American Community Survey and Current Population Survey.³ Costs are estimated using the cost-to-charge ratio provided in NIS and SID.

Previous research has identified hospital and emergency department data as the best source for estimates of nonfatal, armed-assault injuries, even for groups potentially less likely to seek medical care, such as criminals (May et al. 2000; May, Hemenway, and Hall 2002). However, these prevalence estimates only capture victims treated for gunshot wounds at a hospital, and it is possible that variations among states in hospital use for armed assault could affect these findings.

Findings

Prevalence

Table 3 shows the rate of hospital use for firearm-assault injury nationally and across the six study states. Nationally, 14.4 people out of every 100,000 had any hospital use for a firearm-assault injury in 2010. Rates in both Maryland (15.5) and North Carolina (15.5) are higher than the national average; rates in New Jersey (8.6) and Wisconsin (5.6) are substantially lower.

TABLE 3

Rate of Hospital Use for Firearm-Assault Injury per 100,000

In select states and the United States, 2010

	Rate per 100,000 population
Arizona	13.1
California	14.3
Maryland	15.5
New Jersey	8.6
North Carolina	15.5
Wisconsin	5.6
Total, United States	14.4

Sources: NEDS, NIS, SEDD, and SID; 2010. Denominator for rate per 100,000 population comes from 2010 CPS.

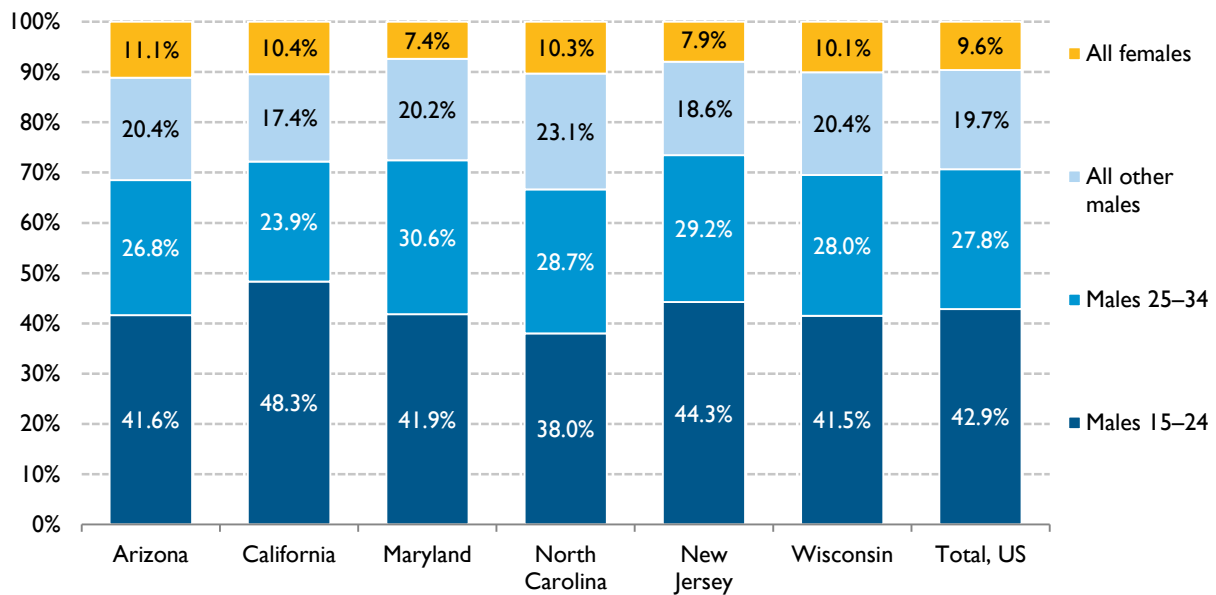
The state averages conceal dramatic race and gender differences in hospital use for firearm-assault injuries. Male victims ages 15 to 24 make up the largest share of firearm-assault-injury hospital use; this share ranges from 38 to 48 percent across the six states investigated (figure 1). Males ages 25 to 34 have the second-largest share and all other males the third-largest share. Conversely, females of all ages compose a comparatively limited share of hospital use by firearm-assault victims; this share ranges from 7.4 percent in Maryland to 11.1 percent in Arizona.

The disparity in hospital use for firearm-assault injury is even more apparent when analyzed by race. Among young people ages 15 to 34, black male youth are much more likely to come to the hospital with a firearm assault injury (figure 2), with a rate 1.7 to 7.2 times higher than the next-highest category, Hispanic males. Black females also have a higher rate than either white or Hispanic females. In every state except Arizona, black females have a higher rate than white males (figures 2 and 3). These findings confirm previous research showing large racial disparities in firearm assault injury hospitalization (Kalesan et al. 2014).

FIGURE 1

Share of Firearm Assault Injury Hospital Use

By gender and age in selected states and United States, 2010



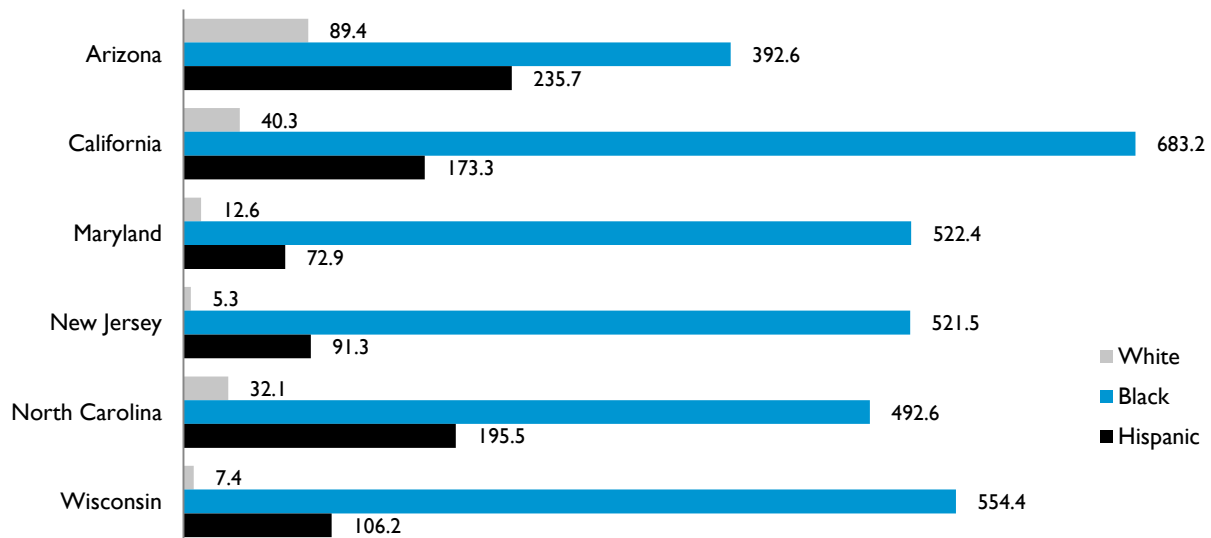
Sources: 2010 data from NEDS, SEDD, NIS, and SID.

Notes: We remove unknown age/sex from the denominator, the largest of which is 2.7 percent of total encounters in California.

FIGURE 2

Rate of Male Firearm Assault Injury Hospital Use per 100,000

For those age 15-34



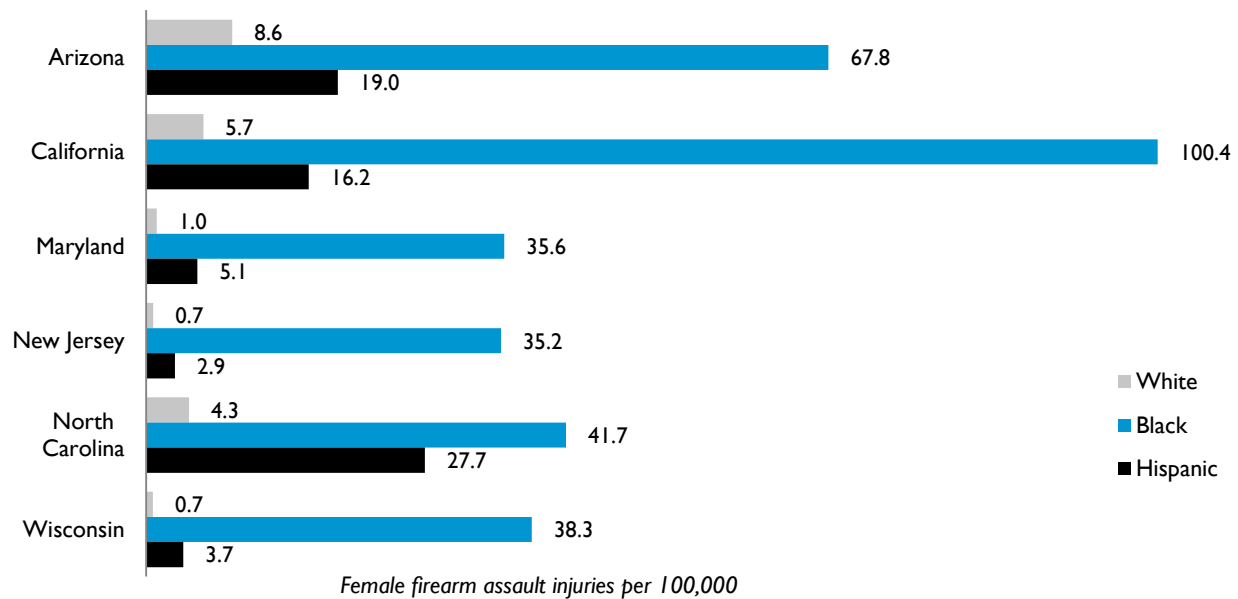
Male firearm assault injuries per 100,000

Sources: 2010 data from NEDS, SEDD, NIS, SID, and the American Community Survey.

FIGURE 3

Rate of Female Firearm Assault Injury Hospital Use per 100,000

For those age 15–34



Sources: 2010 data from NEDS, SEDD, NIS, SID, and the American Community Survey.

Mortality

Firearm-assault-injury hospital mortality—the percentage of firearm-assault hospital emergency department visits or inpatient stays ending with death in the hospital—also varies substantially by state (table 4). North Carolina, which has one of the highest rates of firearm-assault injury hospital use (table 3), has the lowest mortality rate at 4.8 percent; Maryland has the highest mortality rate at 15.6 percent, more than double the national rate (6.5 percent).

TABLE 4

Percentage of Firearm-Assault-Injury Hospital Use Leading to Death

By insurance status in select states and the United States, 2010

	Insured			Total
	Public	Other	Uninsured	
Arizona	4.6	10.4	8.9	6.8
California	7.6	5.9	11.9	8.6
Maryland	12.2	9.5	21.1	15.6
North Carolina	3.5	2.9	6.0	4.8
New Jersey	7.6	3.9	10.1	8.3
Wisconsin	6.8	6.1	6.2	6.5
Total, United States	5.1	5.0	8.4	6.5

Sources: 2010 data from NEDS, NIS, SEDD, and SID.

State variation in hospital mortality for firearm-assault injury is even starker when analyzed by insurance status. In five of the six study states, uninsured victims of firearms assault have higher mortality rates than those with some form of insurance.⁴ In Maryland, for example, mortality is 8.9

percentage points higher for uninsured patients than for publically insured patients, the group with the second-highest mortality rate. In New Jersey and North Carolina, there was only a 2.4 to 2.5 percentage-point difference in mortality between those same groups. Nationally, both the publically and privately insured individuals have about the same mortality rate (5.1 and 5.0 percent), but this is over 3 percentage points below the uninsured mortality rate (8.4 percent). Only in Wisconsin do all three groups have about the same mortality rate, which is close to the national average for all firearm-assault-injury victims (6.5 percent). In five of the six study states, the uninsured have higher hospital mortality than insured individuals. This could be because of a variety of factors, such as patient demographic characteristics, the severity of the wounds, the distance to the hospital (shorter distances could mean more patients arrive alive at the hospital), or hospital quality of care.

Cost

As shown in a previous study (Howell and Abraham 2013), the cost of hospital use for firearm-assault injury is very large: over half a billion dollars nationally in 2010 (table 5). Among the six states studied, the cost ranges from over \$87 million in California to just under \$4 million in Wisconsin.

Most of this cost for is paid for by the public, either through public insurance programs such as Medicaid or as uncompensated care for the uninsured. For all six states, the share of public insurance and uninsured firearm-assault-injury costs combined is over 60 percent (table 5 and figure 4). California has the lowest percentage (64.8); Arizona has the highest (85.0). Nationally, public expenditures offset at least 65 percent of the cost of uncompensated care for the uninsured in 2013 (Coughlin et al. 2014). Doctors also pay a portion of this cost through either in-kind contributions or business losses (Hadley et al. 2008).

TABLE 5

Hospital Costs for Firearm Assault Injury

In select states and the United States, 2010

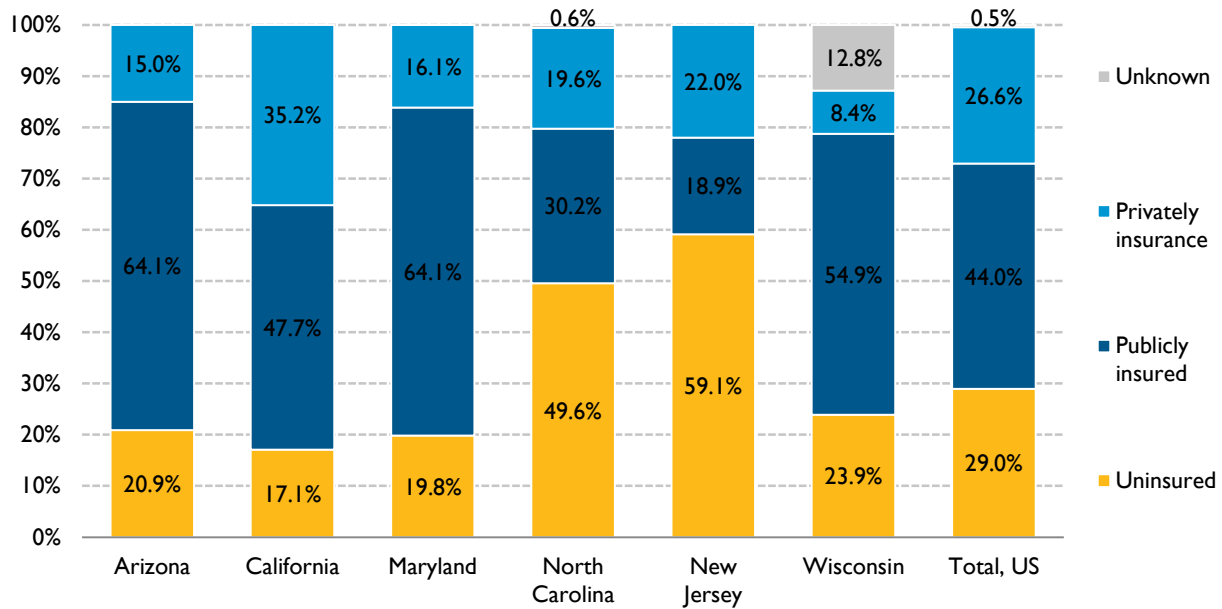
	Total cost (millions)	Costs for publically insured and uninsured (%)
Arizona	\$10.9	85.0
California	\$87.4	64.8
Maryland	\$12.2	83.9
North Carolina	\$12.6	79.8
New Jersey	\$9.9	78.0
Wisconsin	\$3.8	78.7
National	\$669.2	72.9

Sources: 2010 data from NEDS, NIS, SEDD, and SID.

FIGURE 4

Share of Firearm Assault Hospital Costs by Insurance

For the select states and the United States, 2010



Source: 2010 data from NEDS, SEDD, NIS, and SID.

Notes: Inpatient costs may include those incurred during ED stay, per HCUP data documentation. In California, only Inpatient costs are estimated since ED charges are not available.

Conclusions

This analysis finds that the hospital costs of firearm assault injury are large in absolute terms, and they are disproportionately financed with public dollars in six very different states. In a time of restricted public resources, these findings suggest that significant public resources could be saved or redirected if effective gun-violence prevention strategies could be identified.

These findings also support previous research suggesting that the consequences of gun violence are disproportionately concentrated among male youth, specifically young black males. The injuries they sustain likely have prolonged effects on their lives and productivity, rendering clear the importance of identifying steps that prevent the violence from occurring. Hospitalization could provide an opportunity for intervention for the young men, who are also often underserved by the health care safety net. The expansions of health insurance coverage associated with the Affordable Care Act may provide an opportunity for improved access to mental health and substance abuse services for the newly insured, particularly for those subgroups that are at high risk of experiencing firearms injuries.

In five of the six study states, the uninsured have higher hospital mortality than insured individuals, suggesting that there is variation in the quality of hospital care for victims of firearm-assault injury, and that this variation may be related to a victim's health insurance status. These data complement information from an earlier Urban Institute study (Howell and Abraham 2013) that showed that the uninsured are admitted to the hospital from the emergency department less often than insured individuals. This variation by state and insurance status shows the need for more research on the quality of care for victims of firearm-assault injury and that lessons in effective trauma care for victims could be shared across communities and hospitals.

Firearm-assault injuries impose a tremendous burden on some of America's most vulnerable youth, the health care system, and the American public. These data on the scope of the problem and level of public health care expenditures offer policymakers an impetus for seeking cost-effective solutions to an expensive but potentially preventable problem.

Notes

1. Iowa and Vermont were also included in the initial sample, but with fewer than 100 firearm-assault hospital encounters in 2010, they provided insufficient data for analysis.
2. SID and SEDD data for these six states represent a census of hospital use. Firearm assault is defined by the presence of any of the following E-codes in any diagnosis field: E965.0, E965.1, E965.2, E965.3, E965.4, and E979.4. Benchmarking to the Centers for Disease Control and Prevention web-based injury statistics query and reporting system dataset suggests that coding of firearm assault is incomplete for emergency department visits, leading to underreporting of such events in the NEDS. Though charges can be estimated on the NEDS and SEDD, there is no hospital cost-to-charge ratio file for these databases. We take the cost-to-charge ratio for all firearm encounters for the nation and each state (on the NIS and SID, respectively) and multiply by each charge on the NEDS and SEDD to estimate hospital costs for ED treat-and-release encounters. Charges are missing for 0.7 percent of inpatient hospital stays resulting from a firearm assault nationally. For the sample states, charges are only missing in California (3 percent) and New Jersey (0.2 percent). Encounters for which charges are missing are assumed at the average when calculating total costs.
3. Data from the 2010 US Census, American Community Survey and Current Population Survey can be searched online: United States Census Bureau, "American FactFinder," accessed August 18, 2014, <http://factfinder2.census.gov/faces/nav/jsf/pages/index.xhtml>.
4. Though victims with private sources of insurance have higher mortality rates than the uninsured in Arizona, the overall mortality rate for the insured in Arizona is lower than for the uninsured.

References

- Braga, Anothy A., Andrew V. Papachristos, and David M. Hureau. 2010. "The Concentration and Stability of Gun Violence at Micro Places in Boston, 1980–2008." *Journal of Quantitative Criminology* 26 (1): 33–53.
- Coughlin, Teresa A., John Holahan, Kyle Casewell, and Megan McGrath. 2014. "An Estimated \$84.9 Billion in Uncompensated Care Was Provided in 2013; ACA Payment Cuts Could Challenge Providers." *Health Affairs* 33 (5): 807–14.
- David-Ferdon, Corinne, and Thomas R. Simon. 2014. *Preventing Youth Violence: Opportunities for Action*. Atlanta, GA: National Center for Injury Prevention, Centers for Disease Control and Prevention.
- Federal Bureau of Investigation. 2010. *Crime in the United States 2010*. Washington, DC: US Department of Justice.
- Hadley, Jack, John Holahan, Teresa Coughlin, and Dawn Miller. 2008. "Covering the Uninsured in 2008: Current Costs, Sources of Payment, and Incremental Costs." *Health Affairs* 27 (5): 399–415.
- Howell, Embry M., and Peter Abraham. 2013. "The Hospital Costs of Firearm Assaults." Washington, DC: Urban Institute. <http://www.urban.org/publications/412894.html>.
- Kalesan, Bindu, Clare French, Jeffrey A. Fagan, Dennis L. Fowler, and Sandro Galea. 2014. "Firearm-related Hospitalizations and In-Hospital Mortality in the United States, 2000–2010." *American Journal of Epidemiology* 179 (3): 303–12.
- May, John P., David Hemenway, and Alicia Hall. 2002. "Do Criminals Go to the Hospital When They Are Shot?" *Injury Prevention* 8 (3): 236–38.
- May, John P., David Hemenway, Roger Oen, and Khalid R. Pitts. 2000. "Medical Care Solicitation by Criminals with Gunshot Wound Injuries: A Survey of Washington, DC, Jail Detainees." *Journal of Trauma: Injury, Infection, and Critical Care* 48 (1): 130–32.
- Miller, Ted R. 2012. *The Cost of Firearm Violence*. Calverton, MD: Pacific Institute for Research and Evaluation.
- Papachristos, Andrew V., and Christopher Wildeman. "Network Exposure and Homicide Victimization in an African American Community." *American Journal of Public Health* 104 (1): 143–50.