

MILLIMAN RESEARCH REPORT

Cost of community violence to hospitals and health systems

Report for the American Hospital Association

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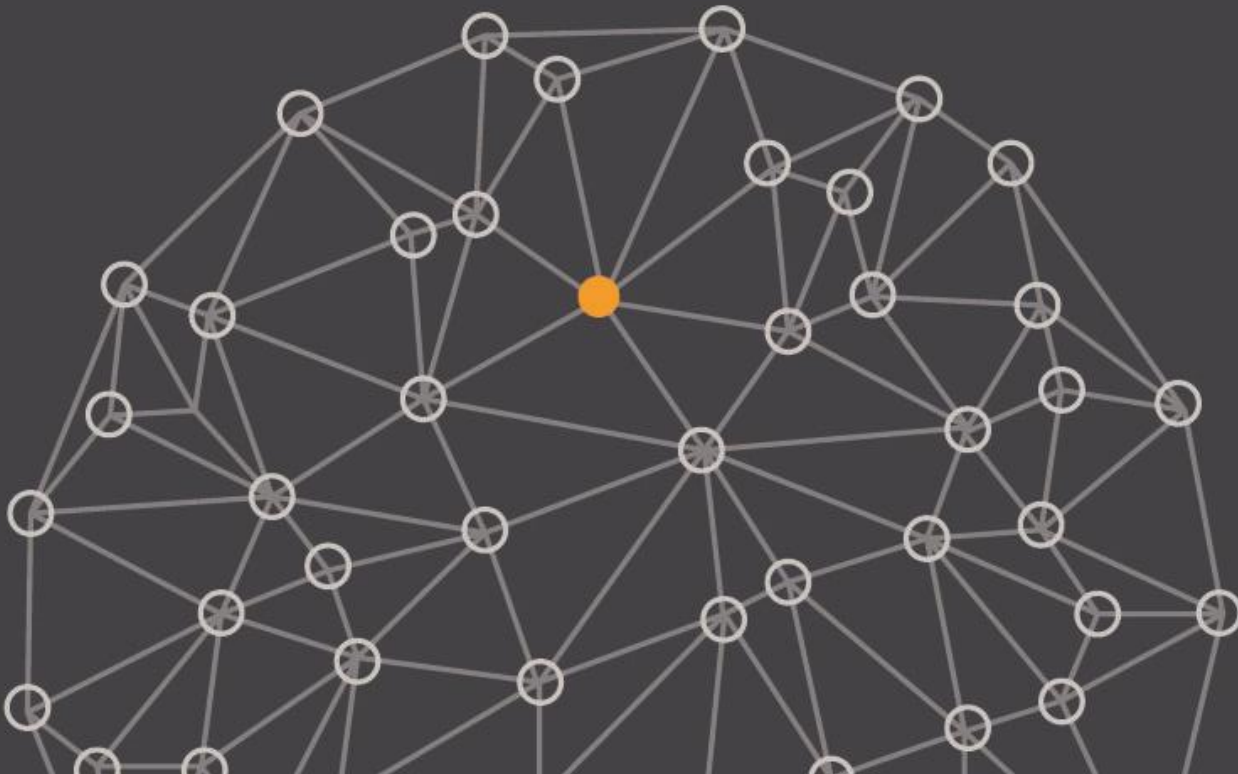




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Executive Summary

Violence in our communities is a serious public health issue, and as such, it is of great concern to hospitals that care for victims of violence and also prepare for possible mass events. While a review of prior research shows that numerous efforts from a range of perspectives have been made to quantify the impact of violence to various stakeholders, a comprehensive estimate of the financial impact to community healthcare resources, specifically hospitals and health systems, has not been accomplished. The American Hospital Association (AHA) has engaged Milliman to conduct a study of the financial impact to hospitals and health systems of dealing with all types of violence within their facilities and communities to better illustrate the enormity of violence as a public health problem. For the purposes of this study, we define violence broadly, to include any intentional use of physical force to cause injury or bodily harm. This report presents the findings of our research.

Hospitals provide critical and lifesaving services to victims of violence within their communities, and also address violence beyond medical care. As key community stakeholders in antiviolence efforts, hospitals engage in prevention and preparedness activities, both to address the determinants of violence within their communities, and to be capable of responding appropriately when violence does occur. Further, healthcare workers face an increased risk of both physical and verbal abuse as they manage the complex needs of patients and visitors within their facilities. Many patients and visitors experience high-stress, emotionally charged situations during their time in the hospital that can sometimes lead to aggressive behavior. As such, hospitals and health systems make significant investments in infrastructure, staff, and training in order to keep their workers, patients, and visitors safe.

In reading this report, it is important to recall that the term “cost” can mean different things to different stakeholders, especially with regard to healthcare. To providers, including hospitals, the “cost” of healthcare is the investment in resources that support the provision of healthcare services to their patients, and this can include direct patient care as well as indirect costs for ancillary functions that support their overall operations. Throughout this report, we examine costs from the viewpoint of hospitals and health systems, identifying the expenditures and resource needs involved in responding to violence within their communities and workplaces.

To quantify the tremendous resources put toward caring for victims of violence and anticipating violent events, we divided costs into the following categories:

- Public violence: Prevention and preparedness costs (proactive).
- Public violence: Post-incident costs (reactive).
- In-facility violence: Prevention and preparedness costs (proactive).
- In-facility violence: Post-incident costs (reactive).

Overall, we estimated that proactive and reactive violence response efforts cost U.S. hospitals and health systems approximately \$2.7 billion in 2016. This includes \$280 million related to preparedness and prevention to address community violence, \$852 million in unreimbursed medical care for victims of violence, \$1.1 billion in security and training costs to prevent violence within hospitals, and an additional \$429 million in medical care, staffing, indemnity, and other costs as a result of violence against hospital employees.

Figure 1 presents a summary of these results. These estimates were derived by assembling data found in peer-reviewed literature, published reports, and primary data analysis of hospital financial statements and medical claims. External data sources contained information specific to the cost of violence to U.S. hospitals, rates of violent crime, general hospital expenditures, labor statistics, and hospital treatment costs for patients.

FIGURE 1: ESTIMATED TOTAL COST OF VIOLENCE TO U.S. HOSPITALS AND HEALTH SYSTEMS, 2016

COST CATEGORY	TOTAL, IN MILLIONS	PER HOSPITAL	% OF TOTAL
GRAND TOTAL	\$2,679.6	\$481,596	100.0%
PUBLIC VIOLENCE: PREVENTION AND PREPAREDNESS	\$279.5	\$50,234	10.4%
EMERGENCY PREPAREDNESS TRAINING	\$174.6	\$31,380	6.5%
COMMUNITY BUILDING RELATED TO VIOLENCE PREVENTION	\$67.6	\$12,150	2.5%
TRAINING TO IDENTIFY VIOLENCE-RELATED TRAUMA	\$37.3	\$6,704	1.4%
PUBLIC VIOLENCE: POST-INCIDENT	\$852.2	\$153,163	31.8%
COST OF UNCOMPENSATED OR UNDERCOMPENSATED CARE	\$752.4	\$135,226	28.1%
MEDICAL CARE	\$651.0	\$117,002	24.3%
BEHAVIORAL CARE	\$101.4	\$18,224	3.8%
CASE MANAGEMENT	\$99.8	\$17,937	3.7%
IN-FACILITY VIOLENCE: PREVENTION AND PREPAREDNESS	\$1,119.4	\$201,186	41.8%
SECURITY STAFF AND INFRASTRUCTURE	\$846.7	\$152,175	31.6%
STAFF TRAINING	\$175.1	\$31,470	6.5%
PROCEDURE DEVELOPMENT	\$97.6	\$17,541	3.6%
IN-FACILITY VIOLENCE: POST-INCIDENT	\$428.5	\$77,013	16.0%
STAFF TURNOVER	\$234.2	\$42,092	8.7%
MEDICAL CARE	\$42.3	\$7,602	1.6%
INDEMNITY	\$7.6	\$1,366	0.3%
DISABILITY	\$90.7	\$16,301	3.4%
ABSENTEEISM	\$53.7	\$9,651	2.0%

We estimated that the largest category of costs for hospitals and health systems was associated with the safety of hospital patients, visitors, and employees. By analyzing the financial statements of 123 hospitals, representing both private and public hospitals, and the relationship between total security spending and local violent crime rates, we estimated that \$1.1 billion in security costs was directly related to preventing or addressing violence on hospital premises. The next largest violence-related cost to hospitals was the unreimbursed and under-reimbursed cost of medical care provided to victims of violence, which we estimated to be \$752 million in 2016.^{1,2} We also estimated that hospitals spent an additional \$100 million in utilization review and case management costs for violence-related care. Hospitals and health systems further incurred significant costs addressing workplace violence. In addition to harming employees, violent incidents can lead to significant costs for workers' compensation losses, overtime, absenteeism, temporary staffing, training costs, higher turnover, additional infrastructure for employee safety, and deterioration of productivity and morale.

We made a number of assumptions to incorporate information from peer-reviewed journals, industry publications, and government reports to develop our estimate of the total costs to hospitals associated with violence. It is the hope of the AHA and Milliman that this work will spark further analysis and dialogue on this important issue, enabling a more refined set of estimates of the cost of violence to hospitals and health systems in the future. The estimates presented in this report should be understood in light of the assumptions, caveats, and limitations described in this report.

¹ It is important to note that in estimating the cost to hospitals and health systems of providing medical care for victims of violence, we only included the portion of actual costs that were not reimbursed by patients or other third parties, such as private insurers, Medicare, or Medicaid, to reflect the cost to hospitals for providing this care. This is a key difference in the medical care portion of our estimates compared with estimates developed in other published literature on the topic that may reflect total cost of care. We compared our results with other available data on the cost of medical care and found these estimates to be reasonable when appropriate adjustments were made to account for differences in methods and scope.

² We estimated that the total costs for medical care provided to victims of violence in 2016 was \$4.8 billion, of which \$752 million was unreimbursed or under-reimbursed.

Introduction

In the United States, violence is a significant public health issue. The impact of violence, wherever it occurs, is felt in our homes and workplaces. The costs to our society are significant and, as such, violence is a major public health concern. As essential partners to their communities in the effort to improve health and well-being, hospitals are key stakeholders in this issue.

In 2005, there were an estimated 308,200 violence-related hospitalizations in the United States,⁴ or about one hospitalization per five violent crimes reported by the FBI in the same year. It is likely that many if not most victims of violence access the healthcare system at some level. There is no comprehensive estimate of the financial impact of violence to hospitals in the United States. There are estimates of important aspects of violence, but there is no estimate of its total cost to U.S. hospitals.

The American Hospital Association (AHA) has engaged Milliman to conduct a study of the financial impact to hospitals and health systems of dealing with all types of violence within their communities and workplaces to better illustrate the enormity of violence as a public health problem. With this report, the American Hospital Association and Milliman have made the first estimate of the total financial cost of the effect of violence on U.S. hospitals. The analysis incorporated a variety of information sources representing a wide range of scopes and methods, and a number of adjustments and assumptions were therefore required to create these estimates. We hope that this effort will provide stakeholders with a better understanding of the magnitude and scope of the financial impact of violence on hospitals, and that the work will highlight areas where additional research can create valuable new insights.

ANALYTICAL FRAMEWORK

Given the broad spectrum of costs that can accrue to hospitals as a result of violence, we focused our analysis on a two-dimensional framework for considering costs. The first dimension categorizes violence by where it was initiated: either in the general public or within the hospital. The “Public Violence” category captures the majority of violent events (occurring in the general public), whereas the “In Facility Violence” category captures violence that takes place within hospitals among patients, visitors, and, less frequently, healthcare workers. According to the Occupational Safety and Health Administration (OSHA), in 2013 80% of serious violent incidents that were reported in healthcare settings resulted from interactions with patients, and the remaining 20% of incidents resulted from visitors, coworkers, or others that entered the hospital environment.⁵ Hospital employees are exposed to many people who are in high-stress, emotionally charged situations, which can sometimes lead to aggressive behavior.

The second dimension we used to categorize the costs to hospitals that resulted from violence differentiates whether the costs resulted from activities that were intended to prevent violence (proactive), or were a response to incidents of violence (reactive). Costs in the former category included spending intended to prevent or prepare for violent events. The latter category includes costs that occurred after violent events had taken place, including the unreimbursed costs for treating victims of violence, as well as any other post-incident costs.

Taken together, these dimensions create a categorization grid for costs as shown in Figure 2.

FIGURE 2: ANALYTIC FRAMEWORK

	PUBLIC VIOLENCE	IN-FACILITY VIOLENCE
PREVENTION AND PREPAREDNESS	EX: EMERGENCY PREPAREDNESS TRAINING	EX: SECURITY INFRASTRUCTURE AND STAFF
POST-INCIDENT	EX: TREATING VICTIMS	EX: DISABILITY BENEFITS

⁴ Russo, A.C., Owens, P.L., & Hambrick, M.M. (March 2008). Violence-Related Stays in U.S. Hospitals, 2005. Agency for Healthcare Research and Quality, Healthcare Cost and Utilization Project. Retrieved July 7, 2017, from <https://www.hcup-us.ahrq.gov/reports/statbriefs/sb48.pdf>.

⁵ OSHA (December 2015). Workplace Violence in Healthcare: Understanding the Challenge. Retrieved July 7, 2017, from <https://www.osha.gov/Publications/OSHA3826.pdf>.

Using this analytical framework, we sought data on costs for subcategories of activities and services within each of the four quadrants of the grid using published literature, data collected by government and other agencies, publicly available hospital financial statements, and original research using medical claims and productivity data. Because our information necessarily came from a variety of sources, and included information of varying degrees of specificity and quality, the resulting cost model we created to develop and describe the hospital costs associated with violence required a number of assumptions in order to be complete. We describe these assumptions and data sources in detail within this report.

In quantifying the financial impact, we have only included costs that were not directly reimbursed by patients or third parties, such as private insurance, Medicare, or Medicaid. While hospitals provided a significant amount of medical treatment for victims of violence, our estimates only included the portion of those costs that was borne by the hospital as community benefit, underpayment, or bad debt.

Public violence: Prevention and preparedness

Hospitals spend substantial resources preparing for the surge of trauma that follows mass-violence events, in addition to the day-to-day violence that occurs within their communities. They also sponsor or initiate violence prevention activities, and train their staff to identify violence-related trauma. We estimated that these efforts cost U.S. hospitals \$279.5 million in 2016, including \$174.6 million for emergency preparedness training, \$67.6 million for community violence prevention, and \$37.3 million for staff training to identify violence-related trauma. These activities are not only practical, but they also have lasting beneficial impacts on the communities they touch. Prevention is the most desirable outcome, but hospitals must be prepared to serve their unique role when violence does occur.

“It’s not a matter of if, it’s a matter of when.”

Dr. Jay Kaplan, president of the American College of Emergency Physicians¹⁰

EMERGENCY PREPAREDNESS TRAINING

Emergency preparedness training, sometimes referred to as surge training, is conducted to prepare the hospital staff “to provide adequate medical evaluation and care when events exceed the limits of the normal medical infrastructure,”⁶ such as during a mass-violence event. These trainings have been proven effective, and hospitals incurred \$174.6 million in costs to conduct these trainings in 2016. In the case of the Orlando nightclub tragedy that occurred on June 12, 2016, the Orlando Regional Medical Center had conducted a full-scale mass-shooting exercise three months prior to the incident. This training prepared the Orlando Regional Medical Center to quickly triage victims, prioritize activities, and acquire the necessary resources to address the situation. For example, on the night of the shooting, only one trauma surgeon was on duty, but within an hour of the shooting an additional five surgeons were in the operating rooms, enabling the hospital to more effectively treat over 50 patients that arrived from the nightclub.⁷ It is clear that these trainings are important for hospitals as a means of increasing capacity to respond to similar events.

A survey of hospitals in 2014 regarding the types of emergency preparedness training that they used⁸ found that all surveyed hospitals used at least one type of training, and 57% used at least three types. The trainings most frequently included simulations of disaster events (90%), classes (88%), lectures (77%), and conferences (75%). In

⁶ U.S. Department of Health and Human Services (February 14, 2012). Public Health Emergency: What is Medical Surge? Retrieved July 7, 2017, from https://www.phe.gov/Preparedness/planning/mscc/handbook/chapter1/Pages/whatismedicalsurge.aspx#fn01_05_001..

⁷ Dulaney, C. (June 13, 2016). Inside the frenzied scene that unfolded at one Orlando hospital. *USA Today*. Retrieved July 7, 2017, from <https://www.usatoday.com/story/news/2016/06/13/hospital-shooting-victims/85836204/>.

⁸ National Association of Public Hospitals and Health Systems (May 2008). EMERGENCY PREPAREDNESS IN PUBLIC HOSPITALS: Complete Findings of the 2006-2007 Emergency Preparedness Study. Retrieved July 7, 2017, from <https://essentialhospitals.org/wp-content/uploads/2014/02/EP-Study.pdf>.

the prior year, 100% of the hospitals surveyed reported that their ER staffs were trained in emergency preparedness. Nursing groups were trained in 95% of the hospitals, and physician groups were trained in 85% of the hospitals.

We used these survey results to inform our estimates of the costs associated with emergency preparedness training. The survey data enabled us to estimate the frequency with which various types of emergency preparedness trainings occurred, and we estimated the costs associated with those trainings by estimating the level of staff involved with each training, in addition to the amount of wages paid for the time that they were participating in those trainings.

The U.S. Bureau of Labor Statistics (BLS) reported that there were 3.8 million professionally active nurses and 708,000 physicians and surgeons in 2016.^{9,10} The BLS also reported that 61% of professionally active nurses worked in hospitals.¹¹ According to a report by the Physicians Advocacy Institute, 38% of physicians were employed by hospitals as of mid-2015.¹² Additionally, the American College of Emergency Physicians estimated that 180,000 nurses and 42,000 physicians worked in the ER.¹³ Overall, we estimated that hospitals conducted 1.5 million trainings of various types each year, utilizing 2.5 million work hours. Using additional BLS data, we estimated an average hourly wage for nurses, physicians, and doctors. Additional BLS data showed that, in 2016, average employer costs for employee compensation were 46% higher than wages and salary alone.¹⁴ The resulting costs to the hospital for an hour of nurse and physician time were estimated to be \$48.77 and \$146.00, respectively. These averages encompass a large range of responsibilities and wages for various levels of professional designations.

Training programs and their costs vary greatly by hospital, and may correlate with the likelihood of experiencing a violent event within a particular facility; however, we were unable to find this level of specificity in our review of industry research. We assumed the cost of classes to be roughly \$600 per participant. This was based on costs reported for the Alert, Lockdown, Inform, Counter, Evacuate (ALICE) training program in Florida,¹⁵ an instructor certification training course designed to train administrators on proactively addressing violent intruder events. A review of emergency preparedness conferences for nurses and other hospital associates showed about the same level of costs for registration fees. Additionally, we assumed that lectures, online training, and email training would predominantly be administered internally, with the primary expenses resulting from the wages paid to employees during the time spent participating in those trainings.

Collectively, we estimated that a total of \$233 million was spent by U.S. hospitals annually for emergency preparedness training. With input from industry experts, we assumed that 75% of this cost, or \$174.6 million, was directly attributable to violence (as opposed to natural disasters or other causes unrelated to violence).

COMMUNITY-BUILDING ATTRIBUTED TO VIOLENCE PREVENTION

As pillars of their communities, hospitals have an opportunity to play an important role in addressing the socioeconomic determinants of violence. In 2016, the cost to hospitals of fulfilling these community needs was \$67.6 million, based on reported spending for community-building activities. Many hospitals engage in community-building activities that address the housing, economic, environmental, workforce, and other needs of vulnerable populations. This can include programs that are focused on violence prevention, or programs that might indirectly reduce some of

⁹ BLS (March 31, 2017). May 2016 National Occupational Employment and Wage Estimates United States: Healthcare Practitioners and Technical Occupations. Retrieved July 7, 2017, from https://www.bls.gov/oes/current/oes_nat.htm#29-0000.

¹⁰ BLS (December 17, 2015). Occupational Outlook Handbook: Physicians and Surgeons: Summary. Retrieved July 7, 2017, from <https://www.bls.gov/ooh/healthcare/physicians-and-surgeons.htm>.

¹¹ BLS (December 17, 2015). Occupational Outlook Handbook: Registered Nurses: Work Environment. Retrieved July 7, 2017, from <https://www.bls.gov/ooh/healthcare/registered-nurses.htm#tab-3>.

¹² Physicians Advocacy Institute. Physician Practice Acquisition Study: National and Regional Employment Changes. <http://www.physiciansadvocacyinstitute.org/Portals/0/assets/docs/PAI-Physician-Employment-Study.pdf>. Accessed 28 April 2017.

¹³ American College of Emergency Physicians (April 2016). Emergency Medicine Statistical Profile. Retrieved July 7, 2017, from <https://www.acep.org/content.aspx?id=25234>.

¹⁴ BLS (June 9, 2017). Employer costs for employee compensation. News release. Retrieved July 7, 2017, from <https://www.bls.gov/news.release/ecec.nr0.htm>.

¹⁵ icFLORIDA.com (June 12, 2017). Active Shooter Training – A.L.I.C.E Training. Retrieved July 7, 2017, from <http://events.icflorida.com/event/active-shooter-training-a-l-i-c-e-training58ebccfcacb3c>.

the causes of violence. In fiscal year (FY) 2012, nonprofit hospitals provided benefits to the community valued at 0.12% of their total expenses.¹⁶

For nonprofit hospitals, tax exemption is accompanied by a community benefit obligation. The actual costs to provide these benefits are reported annually to the Internal Revenue Service (IRS) in Schedule H. According to an analysis prepared by Ernst & Young that reviewed Schedule H, community-building activities accounted for 0.12% of total operating expenses for tax-exempt hospitals, and that level has been stable from 2009 to 2012.¹⁷ As stated in the Ernst & Young report, “These activities often promote regional health by offering direct and indirect support to communities with unmet health needs. These include patients who are indigent, uninsured, underprovided for, or geographically isolated from health care facilities.” A report published by the University of Kentucky estimates that the “community support” category represents 32.3% of the total amount spent by hospitals on community-building activities.¹⁸ Community support can include activities such as the following:

- Child care and mentoring programs
- Neighborhood support groups
- Violence prevention programs
- Disaster readiness

Because of a lack of more refined data, we assumed that the reported community benefit spending was uniformly distributed across these types of activities. Note that there are other types of activities that could be included within this category, and that there may be violence-related spending in other categories reported on Schedule H that we could not readily identify. Specifically, we estimated that 8.1% of community-building spending was generally related to some type of program that was intended to positively impact violence in the community. For-profit community hospitals often invest in community-building activities as well. However, their community-building expenses tend to represent a smaller portion of their operating expenses.¹⁹

According to the AHA, community hospital expenditures in 2015 totaled \$851.5 billion.²⁰ Assuming an annual trend rate of 3.3%, 2016 hospital expenditures would be \$879.6 billion. Of that total, we estimated that \$67.6 million was spent on community-building activities generally related to preventing violence. Psychiatric hospitals, long-term care hospitals, and federal government hospitals were excluded from this estimate.

TRAINING TO IDENTIFY VIOLENCE-RELATED TRAUMA

Training hospital staff to identify violence-related trauma is an important step in breaking the cycle of violence and providing patients the care that they need. There are a number of online resources available to support hospitals in developing their training and assessment programs for little to no cost. Our estimate included one hour per year for each nurse and doctor who worked in an ER. It also included 40 hours per year for an administrator to prepare and manage the trainings. Using the hourly wage estimate in previous sections, the total estimate was \$37.3 million per year.

¹⁶ Ernst & Young (May 2015). Schedule H Benchmark Report for the American Hospital Association Tax Year 2012. Retrieved July 7, 2017, from <http://www.aha.org/content/15/2012schedhreport.pdf>.

¹⁷ Limited data sets of nonconfidential patient-level information were provided by the following state agencies and data collection partners: Florida Agency for Health Care Administration, Iowa Hospital Association, Illinois Department of Public Health (under Illinois Public Acts 94-027 and 94-0507), New York State Department of Health, Rhode Island Department of Health – Center for Health Data & Analysis, Texas Department of State Health Services, Utah Department of Health - Utah Health Data Committee/Office of Health Care Statistics, Vermont Association of Hospitals and Health Systems – Network Services Organization, and Washington State Department of Health - CHS/Hospital and Patient Data Systems. Each of these contributors disclaims responsibility for any analyses, interpretations, or conclusions that may be created as a result of use of these data sets.

¹⁸ Bakken, E. et al. (December 2014). What “Community Building” Activities Are Nonprofit Hospitals Reporting as Community Benefit? University of Kentucky Frontiers in Public Health Services and Systems Research, Volume 3, Number 5, Article 1. Retrieved July 7, 2017, from <http://uknowledge.uky.edu/cgi/viewcontent.cgi?article=1123&context=frontiersinphssr>.

¹⁹ Nicholson, S., Pauly, M.V., Burns, L.R., Baumritter, A., & Ash, D.A. (2000). Measuring community benefits provided by for-profit and nonprofit hospitals. *Health Affairs* 19, no.6. Retrieved July 7, 2017, from <http://content.healthaffairs.org/content/19/6/168.full.pdf>.

²⁰ American Hospital Association (January 2017). Fast Facts on US Hospitals: Community hospitals. Retrieved July 7, 2017, from <http://www.aha.org/research/rc/stat-studies/fast-facts.shtml#community>.

Public violence: Post-incident

The most visible connection between U.S. hospitals and violence is the treatment of victims of violence. According to the National Crime Victimization Survey (NCVS) administered by the Bureau of Justice Statistics, 2.7 million persons age 12 or older experienced at least one violent victimization in 2015, and because this survey does not include children under age 12, the total number of victims is likely much higher.²¹ A significant portion of these crimes go unreported and are not reflected in FBI crime statistics. This report is unique in that the estimates represent only the uncompensated or undercompensated costs to hospitals for providing care to victims of violence and not the total cost to patients and private insurers. We estimated that uncompensated or undercompensated care to victims of violence cost hospitals \$752.4 million in 2016, while utilization review and case management for violence-related healthcare cost hospitals \$99.8 million.

COST OF UNCOMPENSATED OR UNDERCOMPENSATED CARE

A number of studies have estimated the total medical costs associated with treating victims of various types of violence, but no previous studies have framed the question to focus on the unreimbursed costs that *hospitals* incur. We estimated these costs to be \$752.4 million in 2016. For our estimate, we focused only on the portion of patient care expenses that were not directly reimbursed by patients or third parties, such as private insurance, Medicare, or Medicaid. This approach highlights the important role that hospitals play in bridging the gap between what patients, government, and private insurers pay and the total cost of medical care for victims of violence.

Payment rates for Medicare and Medicaid programs are generally lower than provider reimbursement in the commercial market, and according to the AHA, these rates do not fully cover the total costs incurred by hospitals to provide care. This results in the hospitals absorbing underpayment for care provided to Medicare and Medicaid beneficiaries. In 2015, total underpayments were \$57.8 billion, including a shortfall of \$41.6 billion from Medicare, and \$16.2 billion from Medicaid. Medicare paid hospitals 88% of the costs of providing care, on average, and Medicaid paid 90% of the costs of providing care, on average. Additionally, hospitals provided a significant amount of free and reduced cost care for uninsured or underinsured patients who were not able to pay their bills. The combination of bad debt and financial assistance provided by hospitals to patients with limited financial means created a measure of the level of uncompensated care that hospitals provided. While increases in coverage associated with the Patient Protection and Affordable Care Act (ACA) have somewhat reduced uncompensated care costs, hospitals provided \$35.7 billion in uncompensated care in 2015.²² Combining uncompensated and undercompensated care, hospitals provided \$93.5 billion to cover those costs in 2015.²³

Violence-related hospitalizations

In order to estimate the portion of uncompensated and undercompensated care provided by hospitals related to violence, we analyzed detailed 2013 hospital discharge data for nine states (including Florida, Iowa, Illinois, New York, Rhode Island, Texas, Utah, Vermont, and Washington) to identify violence-related hospitalizations.²⁴

For those nine states, we flagged violence-related discharges using ICD-9 codes. We found broadly consistent methodologies in the literature using ICD billing 995-codes, a large range of ICD E-codes, and a smaller set of ICD V-

²¹ Truman, J.L. & Morgan, R.E. (October 2016). Criminal Victimization, 2015. U.S. Department of Justice, Bureau of Justice Statistics. Retrieved July 7, 2017, from <https://www.bjs.gov/content/pub/pdf/cv15.pdf>.

²² American Hospital Association (December 2016). Uncompensated Hospital Care Cost Fact Sheet. Retrieved July 7, 2017, from <http://www.aha.org/content/16/uncompensatedcarefactsheet.pdf>.

²³ Note that, for the purposes of this analysis, we did not estimate the impact of any “cost shifting” between payers; reimbursement coverage of hospital costs was capped at 100% for commercially insured patients and was not assumed to offset any unreimbursed or under-reimbursed costs for Medicare and Medicaid patients.

²⁴ Limited data sets of nonconfidential patient-level information were provided by the following state agencies and data collection partners: Florida Agency for Health Care Administration, Iowa Hospital Association, Illinois Department of Public Health (under Illinois Public Acts 94-027 and 94-0507), New York State Department of Health, Rhode Island Department of Health – Center for Health Data & Analysis, Texas Department of State Health Services, Utah Department of Health - Utah Health Data Committee/Office of Health Care Statistics, Vermont Association of Hospitals and Health Systems – Network Services Organization, and Washington State Department of Health - CHS/Hospital and Patient Data Systems. Each of these contributors disclaims responsibility for any analyses, interpretations, or conclusions that may be created as a result of use of these data sets.

codes.^{25,26,27} Because the prior research had different research goals, we carefully reviewed the code ranges and descriptions to select the codes that were most relevant to our analysis.²⁸

To accurately estimate the number of violence-related hospitalizations we made an adjustment to account for underreporting of violence-related ICD codes to ensure that our estimates are in line with the literature around violence and care for violence cited in the following approaches. We used a blend of two different approaches to estimate the likely total number of violence-related admits. For the lower bound, we increased our initial findings by a scalar of five, based on a report produced by the Family Violence Prevention Fund that found E-codes are used in less than 20% of verified domestic abuse cases.²⁹ For the upper bound, we estimated the expected total number of violence-related hospitalizations by assuming that the rate of hospitalizations per violent crime would remain constant over time. A 2005 report from the Healthcare Cost And Utilization Project (HCUP) identified 308,200 violence-related hospitalizations, and FBI crime statistics for the same year indicated that about 1.4 million violent crimes occurred, which implies roughly one hospitalization per five violent crimes.^{30,31} Applying the same hospitalization rate to an estimate for the total number of violent crimes in 2015 yielded an estimate of 243,000 violence-related hospitalizations. We believe the 2015 utilization to be an appropriate estimate of 2016 utilization; therefore, we did not trend this utilization estimate. Altogether, we estimated that there were 154,000 to 243,000 violence-related hospitalizations in 2015, and we based our cost estimates on the midpoint of this range at 198,000 hospitalizations.

We estimated the distribution of these hospitalizations by payer (private insurance, Medicare, Medicaid, uninsured, and other) using average hospitalization rates by payer from the state discharge data, along with total population estimates from the U.S. Census Bureau, and estimates of the number of beneficiaries nationwide by payer using data from the Kaiser Family Foundation.^{32,33,34} Overall, we estimated that 30% of violence-related hospitalizations were for patients with private insurance, 35% were for Medicaid beneficiaries, 22% were for Medicare beneficiaries, 9% were for uninsured patients, and the remaining 3% of hospitalizations were for patients with other types of insurance. Figure 3 presents our estimates of the percentage of all hospitalizations that were related to violence and the total number of violence-related admits by payer.

FIGURE 3: ESTIMATED INCIDENCE OF VIOLENCE-RELATED HOSPITALIZATIONS BY PAYER, 2015

PAYER	% OF HOSPITALIZATIONS DUE TO VIOLENCE	TOTAL VIOLENCE-RELATED HOSPITALIZATIONS	% OF TOTAL
PRIVATE INSURANCE	0.5%	59,997	30.2%
MEDICAID	0.8%	70,096	35.3%
MEDICARE	0.3%	43,963	22.2%
UNINSURED	1.3%	18,276	9.2%

²⁵ Schafer, S.D., Drach, L.L., Hedberg, K., & Kohn, M.A. (September-October 2008). Using Diagnostic Codes to Screen for Intimate Partner Violence in Oregon Emergency Departments and Hospitals. Public Health Reports. Retrieved July 7, 2017, from <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2496936/>.

²⁶ Cohn, F., Rudman, W., Bankhead, T., & Watzlaf, V. A Comparison of ICD-10-CM and ICD-9-CM for Capturing Domestic Violence. AHIMA Foundation. Retrieved July 7, 2017, from https://www.ahimafoundation.org/downloads/pdfs/FVFP_domesticviolencepres.pdf.

²⁷ Kaiser Family Foundation. Health Insurance Coverage of the Total Population: 2015. Retrieved July 7, 2017, from <http://kff.org/other/state-indicator/total-population/?currentTimeframe=0&sortModel=%7B%22colId%22:%22Location%22,%22sort%22:%22asc%22%7D>.

²⁸ Including ICD-9 codes 995.5, 995.8, E950-E966, E968-E969, and E980-E989.

²⁹ Rudman, W.J. (December 2000). Coding and Documentation of Domestic Violence. The University of Mississippi Medical Center, School of Health Related Professions. Retrieved July 7, 2017, from <https://www.futureswithoutviolence.org/userfiles/file/HealthCare/codingpaper.pdf>.

³⁰ Russo, A.C., Owens, P.L. & Hambrick, M.M. (March 2008). Violence-Related Stays in U.S. Hospitals, 2005. Agency for Healthcare Research and Quality. Healthcare Cost and Utilization Project. Retrieved July 7, 2017, from <https://www.hcup-us.ahrq.gov/reports/statbriefs/sb48.pdf>.

³¹ FBI. Crime in the United States 2013. Retrieved July 7, 2017, from https://ucr.fbi.gov/crime-in-the-u.s/2013/crime-in-the-u.s.-2013/tables/1tabledatadecoverviewpdf/table_1_crime_in_the_united_states_by_volume_and_rate_per_100000_inhabitants_1994-2013.xls.

³² U.S. Census Bureau (2016). Current Population Survey. Retrieved July 7, 2017, from <https://www.census.gov/cps/data/cpstablecreator.html>.

³³ Kaiser Family Foundation, *ibid*.

³⁴ Kaiser Family Foundation, *ibid*.

OTHER	0.9%	6,012	3.0%
TOTAL	0.5%	198,345	100.0%

In order to estimate the associated costs to hospitals resulting from violence-related hospitalizations, we assumed that the percentage of hospitalizations that are due to violence was a reasonable proxy for estimating the percentage of total uncompensated care or underpayments that were due to violence. For example, we estimated that 1.3% of hospitalizations for uninsured patients were violence-related, and therefore assumed that 1.3% of the total uncompensated care provided to the uninsured was violence-related. Additionally, we assumed that because hospitals set payment rates for private insurance and other nonpublic insurance programs through negotiations that payment rates for those payers would generally be sufficient to cover the hospitalization costs of patients insured by those payers. Trending total uncompensated and undercompensated care to 2016 estimates, we estimated that an overall \$134.5 million of Medicaid underpayments, \$123.2 million of Medicare underpayments, and \$494.8 million of uncompensated care for uninsured patients could be attributed to violence-related hospitalizations. We divided this cost between medical/surgical and behavioral healthcare hospitalizations based on Diagnosis-Related Group (DRG) codes. Detailed results are provided in Figure 4.

FIGURE 4: ESTIMATED COSTS OF UNCOMPENSATED OR UNDERCOMPENSATED CARE BY PAYER, 2016 (IN MILLIONS)

PAYER	MEDICAL	BEHAVIORAL	TOTAL
PRIVATE INSURANCE	\$0	\$0	\$0
MEDICAID	\$120.9	\$13.6	\$134.5
MEDICARE	\$108.4	\$14.7	\$123.1
UNINSURED	\$421.7	\$73.1	\$494.8
OTHER	\$0	\$0	\$0
TOTAL	\$651.0	\$101.4	\$752.4

UTILIZATION MANAGEMENT

Utilization management provided by hospitals improves outcomes, reduces readmissions, reduces the average length of stays, ensures appropriate care is given, and supports revenue cycle effectiveness. We assumed that utilization management costs as a percentage of patient care costs was consistent between care for victims of violence- and non-violence-related hospital care, resulting in a \$99.8 million cost to hospitals in 2016. We estimated overall utilization management costs by analyzing the financial statements of 178 California hospitals made public by the California Office of Statewide Health Planning and Development (OSHPD).³⁵ We reviewed the reported utilization management costs in comparison with the total cost of patient care for 140 of the 178 hospitals based on the financial statements. The remaining 38 hospitals did not report any case management costs, implying that this cost was not broken out at the level of detail required for our analysis. Among these hospitals, we found that utilization management accounted for 2.1% of total patient care costs. We estimated the total cost of providing patient care to victims of violence, including compensated and uncompensated care, to be \$4.8 billion. Assuming the 2.1% of the total patient care costs for all hospitals, we arrived at our cost of utilization management related to violence of \$99.8 million.

We considered hospital mix as a possible variable for extrapolating from one state to the national level. We stratified the hospitals into quartiles based on their costs of total patient care. The percentage of case management was stable across the quartiles. This implies that case management costs were similar across hospitals regardless of volume.

³⁵ State of California Office of Statewide Health Planning and Development (2017). Financial Disclosure Reports. Retrieved July 7, 2017, from <https://siera.oshpd.ca.gov/financialdisclosure.aspx>.

In-facility violence: Prevention and preparedness

Hospital administrators understand the higher-than-average potential for security threats or violent events that can occur in the workplace. In a 2015 report, OSHA stated that “healthcare and social assistance workers experienced 7.8 cases of serious workplace violence injuries per 10,000 full-time equivalents (FTEs) in 2013. Other large sectors such as construction, manufacturing, and retail all had fewer than two cases per 10,000 FTEs.”³⁶ Therefore, at least some portion of a hospital’s budget each year must cover violence-preventing security measures, whether in the form of hiring security staff, installing security infrastructure, providing staff training, and the like.

We chose to use those costs (i.e., security staff and security infrastructure) along with staff training costs, procedure development costs, and involvement in developing public policy on violence-related issues, such as combating human trafficking, as the four pillars upon which we built an estimate of \$1.1 billion for the category of proactive violence prevention costs within the hospital workplace. This estimate of violence-related costs can be broken down as \$846.7 million in security costs, \$175.1 million in staff training, and \$97.6 million in procedure development.

SECURITY COSTS

The AHA conducts surveys each year on hospital expenses, and reported that in 2015 U.S. registered hospitals had a total of \$936.5 billion in expenses.³⁷ We assumed a medical trend of 3.3% to arrive at a 2016 estimate of total hospital expenses of \$967.4 billion. We analyzed the financial statements of 178 California hospitals³⁸ and found that approximately 0.5% of total expenses were dedicated to security costs. This suggests that hospitals spent \$4.7 billion on security in 2016, and we estimated that \$847 million of this cost addresses violence.

Hospitals require security to address more than just workplace violence. For example, security is required to prevent theft, protect private patient records, and deter vandalism. Because no information was available to estimate the portion of security costs allocated to violence, we studied individual hospital security expenses to develop an estimate. Specifically, we studied the relationship between the violent crime rates surrounding each hospital and the hospital-specific security costs relative to overall expenses.

We used a regression model to isolate the impact that the local violent crime rate had on security spending at hospitals. Our final regression model also normalized for property crime and population, using crime rate data from the California Department of Justice.³⁹ Results of this analysis show that the relationship between hospital spending on security and the local crime rate (controlled for population size) is significant, although not a strong relationship. That is to say, local crime rates do affect hospital spending on security to some extent.⁴⁰

Using the regression results, we estimated the security costs incurred by a hospital as a proportion of total expenses for each hospital. We then decomposed the individual hospital estimates into the components driven by violent crime, property crime, population, and the intercept (all other drivers). On average, the local crime rate (both violent crime and property crime) coefficients accounted for 74% of the hospital security cost estimates, when weighted using total patient care costs. After adjusting for differences between California and national average rates of violent and property crime, we estimated that 18.2% of security spending at hospitals nationwide was attributable to local violent crime rates, and 55.9% was attributable to local property crime rates. Overall, we estimated that hospitals spent 18.2% of the \$4.7 billion spent on security, or \$846.7 million, as a result of violence.

STAFF TRAINING AND PROCEDURE DEVELOPMENT

Unfortunately, some violent incidents can occur before security staff can intervene, so hospitals train healthcare workers in violence prevention and de-escalation techniques. We estimated that a total of \$175.1 million was spent on such healthcare staff training in 2016, in addition to \$97.6 million allocated to prevention plan development.

³⁶ OSHA (December 2015). Preventing Workplace Violence: A Road Map for Healthcare Facilities. Retrieved July 7, 2017, from <https://www.osha.gov/Publications/OSHA3827.pdf>.

³⁷ American Hospital Association, Fast Facts on US Hospitals: Community hospitals, *ibid*.

³⁸ State of California Office of Statewide Health Planning and Development (2017). Financial Disclosure Reports, *ibid*.

³⁹ California Department of Justice (2017). Crimes and Clearances Data, 2006-2015. Retrieved April 27, 2017, from https://openjustice.doj.ca.gov/downloads/crimes_data_2006-2015.csv.

⁴⁰ R-square = 0.112 (F = 4.979, p = 0.003).

Staff training

A recent *Modern Healthcare* article discussed violence in healthcare settings and cited that one system's emergency room (ER) initiative spent \$10,000 to train 90 ER staff members in violence response,⁴¹ or approximately \$111 per staff member. Additionally, all staff members were required to complete online evacuation training. Our review of literature suggests that ERs are developing and requiring this type of training for their employees, but financial costs associated with these trainings do not appear in the literature. We therefore developed the staff training estimate by assuming \$111 per ER doctor or nurse. Additionally, we assumed one hour of additional training for each physician and nurse in the hospital.

According to the Emergency Medicine Statistical Profile developed by the American College of Emergency Physicians,⁴² there were roughly 35,600 board certified ER physicians and 180,000 ER nurses in the United States. The BLS reported 3.75 million nurses in the U.S. workforce in 2016,⁴³ 61% of which worked in hospitals⁴⁴ (for a total of 2.3 million hospital nurses), while a similar source counted 708,300 physicians and surgeons in the U.S. workforce in 2016,⁴⁵ among which 38% were employed by hospitals.⁴⁶

We used the same cost assumptions for staff time as in our development of the public violence preparedness training previously discussed. Using these assumptions, we developed an overall estimate that hospitals spent \$175.1 million on staff training.

Prevention plan development

OSHA encourages all hospital facilities to develop a written violence prevention plan. As of April 1, 2017, healthcare providers in California are required to establish, implement, and maintain an effective workplace violence prevention plan.⁴⁷ We assumed that a team of one hospital administrator, one doctor, and three nurses, per U.S. hospital, could design said prevention plan. Assuming that the employer cost for a senior hospital administrator is the same as that of a physician (\$146 per hour), using \$49 per hour as the compensation rate for each nurse,⁴⁸ and assuming this team spends 40 hours each year developing a prevention plan, we estimated an annual cost of \$17,500 per hospital, or about \$97.6 million in total, on prevention plan development.

In-facility violence

Violence that involves a staff member, whether from a patient, visitor, or another employee, has a significant impact on the operations of the hospital. Workplace violence leads to increased staff turnover, medical care, lost productivity, and a host of other issues for injured employees. Many studies on this issue focus on a single hospital system or clinic to illustrate the experiences of limited events. We hoped to add a broader perspective on the issue with our research, where we estimated national in-facility violence costs of \$428.5 million, including \$234.2 million for staff turnover, \$42.3 million in medical care and indemnity (compensation for lost wages made to employees who were injured on the job) for employee victims of violence, and \$90.7 million in disability and absenteeism costs.

STAFF TURNOVER

Although rare, violence could result in the loss of staff. The cost to replace a nurse or doctor varies greatly within the literature. A 2016 study by the Nursing Solutions, Inc. found that replacing a nurse can cost between \$37,700 and \$58,400.⁴⁹ The same study found nurse turnover rates to be 17.2% of the total workforce per year. There is also a large variation in the literature for the estimate to replace a doctor. A 1999 study in the *American Journal of Managed*

⁴¹ Whitman E. (March 11, 2017). Quelling a storm of violence in healthcare settings. *Modern Healthcare*. Retrieved July 7, 2017, from <http://www.modernhealthcare.com/article/20170311/MAGAZINE/303119990>.

⁴² American College of Emergency Physicians, Emergency Medicine Statistical Profile, *ibid*.

⁴³ BLS (March 31, 2017), *ibid*.

⁴⁴ BLS (December 17, 2015), *ibid*.

⁴⁵ BLS (December 17, 2015), *ibid*.

⁴⁶ Nicholson, *ibid*.

⁴⁷ California Occupational Safety and Health Standards Board. Proposed State Standard, Title 8, Chapter 4. Standards Presentation. Retrieved July 7, 2017, from <http://www.dir.ca.gov/oshsb/documents/Workplace-Violence-Prevention-in-Health-Care-proptxt.pdf>.

⁴⁸ BLS (March 31, 2017), *ibid*.

⁴⁹ Nursing Solutions, Inc. (2016). 2016 National Healthcare Retention & RN Staffing Report. Retrieved July 7, 2017, from <http://www.nsinursingsolutions.com/Files/assets/library/retention-institute/NationalHealthcareRNRetentionReport2016.pdf>.

Care found the cost to replace a general internal practitioner to be \$245,128,⁵⁰ in line with more recent high-level estimates of \$250,000 per physician.⁵¹ These estimates did not include potential lost revenue while the position was being filled. The turnover rate for physicians was lower than nurses, but in 2013, it was at its highest (since 2005). The American Medical Group Association found the turnover rate for physicians to be 6.8%.⁵²

Although workplace violence is stated as a potential reason that practitioners leave their positions, we were unable to find a study that attempted to estimate the magnitude of this factor. An article in *Managed Care* attempted this but did not list violence as a reason for voluntary separation. However, a broad “other” category accounted for 7% of physician turnover. We assumed that violence would necessarily be contained within this “other” category, and conservatively assumed that 1% of turnover might be related to violence after discussion with industry professionals. Using these assumptions, our estimate of the cost of turnover that is due to violence was \$234.2 million.

MEDICAL CARE AND INDEMNITY COSTS

In 2011, the CDC created the Occupational Health Safety Network (OHSN) with collaborating partners to track occupational injuries to help target prevention efforts.⁵³ In 2015, they reported an incidence rate for workplace violence of 4.9 incidents per 10,000 worker months for healthcare workers. This translates to 58.8 events annually per 10,000 workers. Based on this factor, we estimated a total of 13,472 reported violent events toward nurses and 1,583 violent events toward doctors in 2016. A 2014 study conducted by nurses at a large U.S. urban/community hospital system showed that 2.1% of its nurses reported injuries from inpatient violence.⁵⁴ These injuries resulted in average medical costs of \$2,631 per injury, with an additional \$508 in indemnity costs. By applying these cost estimates (trended at 3.3% to 2016 levels) and incidence rates to the number of nurses and doctors employed by hospitals nationwide, we estimated total medical costs of \$42.3 million and indemnity costs of \$7.6 million that are due to violence against healthcare workers.

DISABILITY AND ABSENTEEISM

In order to estimate the costs associated with absenteeism and disability benefits for healthcare workers injured by workplace violence, we analyzed Truven MarketScan® research databases, including medical claims, membership, and databases of absenteeism from employer payroll systems, as well as long-term and short-term disability benefit databases. These detailed databases enabled us to determine the excess in absence hours in the form of sick, disability, and leave time and the excess days for long-term and short-term disability for those who have a violence-related injury compared with those who do not. We identified a subset of members who had full eligibility for inclusion in each of the relevant databases, and then examined their medical claims to stratify the population between those who had and had not been treated for violent injuries. These two cohorts consisted of 343 and 284,142 lives, respectively. We then compared their average absence hours and disability days.

Victims of violence experienced an average of 112.8 hours per year of sick, disability, and leave time, excluding long-term and short-term disability. This was 60.4 more hours per year than their non-violence-related victim counterparts. Using the same rate of workplace violence assumptions as we used in calculating the medical and indemnity costs, we estimated that absenteeism related to workplace violence cost hospitals \$53.7 million per year.

Similarly, victims of violence experienced, on average, 7.1 long-term and 15.2 short-term disability days. This was 6.5 and 12.7 more disability days, respectively, than their non-violence-related victim counterparts. We assumed that disability benefit policies would cover 50% and 75% of wages for long-term and short-term disability, respectively, which is in line with industry standard benefit levels. In total, we estimated that disability related to workplace violence cost hospitals \$90.7 million.

⁵⁰ Buchbinder, S.B., Wilson, M., Melick, C.F., Powe, N.R. (November 5, 1999). Estimates of costs of primary care physician turnover. *American Journal of Managed Care*, (11): 1431-8. Retrieved July 7, 2017, from <https://www.ncbi.nlm.nih.gov/pubmed/10662416>.

⁵¹ American Academy of Family Physicians. The cost of hiring a new doctor. Retrieved July 7, 2017, from <http://www.aafpins.com/2013/04/the-cost-of-hiring-a-new-doctor/>.

⁵² ScienceDaily (August 21, 2014). Physician turnover remains high as more physicians retire. American Medical Group Association. Retrieved July 7, 2017, from <https://www.sciencedaily.com/releases/2014/08/140821115632.htm>.

⁵³ Gooma, A.E., et al. (April 24, 2015). Occupational Traumatic Injuries Among Workers in Health Care Facilities – United States, 2012-2014. CDC Morbidity and Mortality Weekly Report. Retrieved July 7, 2017, from <https://www.cdc.gov/mmwr/preview/mmwrhtml/mm6415a2.htm>.

⁵⁴ Speroni, K.G., Fitch, T., Dawson, E., Dugan, L., & Atherton, M. (September 13, 2013). Incidence and cost of nurse workplace violence perpetrated by hospital patients or patient visitors. *J Emerg Nurs* 40(3):218-28. Retrieved July 7, 2017, from <https://www.ncbi.nlm.nih.gov/pubmed/24054728>.

Discussion

A summary of our overall estimates can be found in Figure 5.

FIGURE 5: ESTIMATED TOTAL COST OF VIOLENCE TO U.S. HOSPITALS AND HEALTH SYSTEMS, 2016, IN MILLIONS

	PUBLIC VIOLENCE	IN-FACILITY VIOLENCE
PREVENTION AND PREPAREDNESS	\$279.5 (10.4%)	\$1,121.5 (41.8%)
POST-INCIDENT	\$852.2 (31.8%)	\$428.5 (16.0%)

Given the abundance of literature on the costs of violence in terms of treatment, it is worth noting that over 50% of the cost of violence to U.S. hospitals is related to prevention and preparedness. This report provides an estimate of the uncompensated care related to violence, and the magnitude of this cost to U.S. hospitals is significant at over \$850 million.

With a 2016 cost of over \$2.7 billion, it is clear that U.S. hospitals incur significant expenses related to violence. Additionally, our findings make it clear that the violence present in the United States necessitates that hospitals incur significant costs to prepare to support the needs of the public and their employees. These expenses are required to enable a hospital to provide care to victims of violence, protect hospital employees, and prevent future acts of violence.

Much work has been done to study the impacts of violence and to identify appropriate steps to curb workplace violence, including work focused within healthcare, but this report seeks to better illustrate the enormity of violence as a public health problem by highlighting the resource demands that violence places on hospitals. In producing this report, it became clear that there is a void of literature on the financial costs incurred by hospitals for addressing violence. We encourage others to continue to refine the estimates developed for this report. In particular, information is largely unavailable regarding the costs associated with training hospital staff. Significant violence-related training is required to address the demands placed on hospitals and their staffs by society, government, and themselves. The lack of publicly available data about the cost to provide this training makes it difficult for healthcare leaders and policy makers to plan for potential resource needs.

Appendix A presents a summary of key assumptions used in analysis.

LIMITATIONS

This report seeks to add a comprehensive view of the financial impact of violence on hospitals. In an effort to capture all relevant areas of expenses, we included several components of hospital spending for which previous literature is limited or nonexistent. Milliman filled some of these gaps through original research conducted on national claims databases and hospital financial reporting. These areas included uncompensated care provided to victims of violence and security costs addressing workplace violence. We note that while these estimates were based on actual claims data and audited financial reporting, several assumptions were required to appropriately adjust the data to reflect expenses related to violence. The key assumptions section above discusses the critical assumptions that we relied upon.

When neither relevant literature nor data appropriate for direct research were available, we used existing literature and available data to identify the activities hospitals were undertaking to address violence. We then used available information to inform our development of the financial burden these activities placed on hospitals. In particular, we note the following areas: the financial quantification of surge training, trauma identification training, workplace violence hazard detection, and hospital-based community violence prevention programs. We included these assumptions in Appendix A, and we note the opportunity for primary research to understand in greater detail the costs associated with internal hospital training efforts related to violence.

Caveats

We attempted to include as much relevant literature as possible under the constraints inherent to such a project. Not all material included in this report may be applicable to all hospitals and health systems. Each system is unique and professional judgment should guide how best to use the information included in this report.

We relied on a variety of publicly available publications and databases for this report as cited throughout. To the extent that any of these publications or databases are inaccurate or incomplete, this report will likewise be inaccurate or incomplete.

In developing these estimates, we relied upon a number of public and nonpublic data sources. Public data sources included:

- The U.S. Bureau of Labor Statistics
- California Office of Statewide Health Planning and Development
- Other sources cited in footnotes throughout this report

We have not audited any of these data sources, although we did review all of them for reasonability and consistency. To the extent that these data sources contain inaccuracies, so may our analysis.

This report provides our best estimate (with reasonable sensitivity testing) of 2016 hospital costs associated with violence. Milliman does not advocate for or against any action (including the passage or defeat of any legislation) based on our analysis. Milliman does not intend to benefit or create a legal duty to any third-party recipients of its work.

Guidelines issued by the American Academy of Actuaries require actuaries to include their professional qualifications in all actuarial communications. Jill Van Den Bos and Nick Creten are members of the American Academy of Actuaries, and meet the qualification standards for performing this analysis.

The authors would like to acknowledge the contributions of Dallan Carter, Janice Packett Evans, and Marlene Howard, FSA, MAAA. Dallan and Janice provided key analytical support, and Marlene reviewed our findings and report and provided valuable insights.

Appendix A: Key assumptions

In this section we highlight several assumptions that were used frequently (see Figure 6), as well as assumptions to which the final overall estimate is particularly sensitive (see Figure 7). Additionally, we highlight the assumptions used to develop the training cost estimates for which limited data was available (see the Staff Training subsection). Finally, we discuss the assumptions used to extrapolate specific data points to national estimates (see the National Estimate Development subsection).

FIGURE 6: ASSUMPTIONS USED THROUGHOUT THE DEVELOPMENT OF THE COST MODEL

DESCRIPTION	ASSUMED VALUE	SOURCE
CPI-MEDICAL TREND	3.3%	U.S. BUREAU OF LABOR STATISTICS
HEALTHCARE WORKPLACE VIOLENCE INCIDENCE RATE PER 10,000 FTES	58.8	CENTERS FOR DISEASE CONTROL AND PREVENTION
ACTIVE U.S. DOCTORS AND SURGEONS	708,300	U.S. BUREAU OF LABOR STATISTICS
ACTIVE U.S. NURSES	3,755,940	U.S. BUREAU OF LABOR STATISTICS
PHYSICIANS EMPLOYED BY HOSPITALS	38%	PHYSICIAN ADVOCACY INSTITUTE
NURSES WORKING IN HOSPITALS	61%	U.S. BUREAU OF LABOR STATISTICS
BOARD CERTIFIED EMERGENCY ROOM DOCTORS	35,662	AMERICAN COLLEGE OF EMERGENCY PHYSICIANS
ACTIVE EMERGENCY ROOM NURSES	180,000	AMERICAN COLLEGE OF EMERGENCY PHYSICIANS
REGISTERED U.S. HOSPITALS	5,564	AMERICAN HOSPITAL ASSOCIATION
NURSE HOURLY WAGE	\$33	U.S. BUREAU OF LABOR STATISTICS
PHYSICIAN HOURLY WAGE	\$100	U.S. BUREAU OF LABOR STATISTICS
EMPLOYER COST OF EMPLOYMENT VERSUS WAGE AND SALARY	1.46	U.S. BUREAU OF LABOR STATISTICS

FIGURE 7: ASSUMPTIONS THAT SIGNIFICANTLY IMPACT THE OVERALL ESTIMATE

DESCRIPTION	ASSUMED VALUE	SOURCE
PROPORTION OF SECURITY COSTS ADDRESSING VIOLENCE	18.2%	ORIGINAL RESEARCH
DISCHARGES RELATED TO VIOLENCE	VARIABLES: AVERAGE = 0.5%	ORIGINAL RESEARCH, FAMILY VIOLENCE PREVENTION FUND, FBI CRIME STATISTICS
MEDICAID AGGREGATE UNDERPAYMENT	\$16.2 BILLION IN 2015	AMERICAN HOSPITAL ASSOCIATION
MEDICARE AGGREGATE UNDERPAYMENT	\$41.6 BILLION IN 2015	AMERICAN HOSPITAL ASSOCIATION
UNINSURED AGGREGATE UNCOMPENSATED CARE	\$35.7 BILLION IN 2015	AMERICAN HOSPITAL ASSOCIATION
STAFF TURNOVER RELATED TO VIOLENCE	1%	AMERICAN HOSPITAL ASSOCIATION
FOR-PROFIT HOSPITAL SPEND ON COMMUNITY BUILDING	50% OF NONPROFIT HOSPITAL RATE	

Staff training

We made assumptions around training to identify violence-related trauma in patients, emergency preparedness, incidence response, and prevention plan development that may or may not have been representative of any one hospital. These assumptions were chosen either to be conservative or to represent a midpoint based on conversations with industry professionals. Notable assumptions were:

- 20% of non-ER doctors and nurses are trained annually in emergency preparedness
- 50% of ER and 5% of non-ER doctors and nurses participate in emergency simulations per year
- 75% of emergency preparedness training is attributable to violence
- 1 hour per year is spent by doctors and nurses in trauma identification training
- 2 hours per year are spent by doctors for training in incidence response
- 40 hours per year are spent by an administrator to develop and conduct trauma identification training
- 40 hours per year are spent by a team of one administrator, one doctor, and three nurses to develop procedures around prevention and preparedness
- \$10,000 cost to train 90 ER staff members in de-escalation

National estimate development

Several estimates and assumptions were developed at the individual nurse, physician, emergency room, or hospital level. To the extent that the estimates and assumptions used were based on individual studies not necessarily representative of the U.S. healthcare system as a whole, these national estimates may be biased. Where possible, we made an effort to explicitly adjust for these biases and use metrics appropriate for extrapolation, such as adjusting costs into percentage of operating expenses. Several assumptions were developed using publicly available financial reports specific to the state of California. To the extent that California hospitals are biased in their security or utilization management spending relative to the rest of the United States, the extrapolation to national estimates will also be biased.