Hospital-Based Shootings in the United States: 2000 to 2011

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Study objective: Workplace violence in health care settings is a frequent occurrence. Emergency departments (EDs) are considered particularly vulnerable. Gunfire in hospitals is of particular concern; however, information about such workplace violence is limited. Therefore, we characterize US hospital-based shootings from 2000 to 2011.

Methods: Using LexisNexis, Google, Netscape, PubMed, and ScienceDirect, we searched reports for acute care hospital shooting events in the United States for 2000 through 2011. All hospital-based shootings with at least 1 injured victim were analyzed.

Results: Of 9,360 search "hits," 154 hospital-related shootings were identified, 91 (59%) inside the hospital and 63 (41%) outside on hospital grounds. Shootings occurred in 40 states, with 235 injured or dead victims. Perpetrators were overwhelmingly men (91%) but represented all adult age groups. The ED environs were the most common site (29%), followed by the parking lot (23%) and patient rooms (19%). Most events involved a determined shooter with a strong motive as defined by grudge (27%), suicide (21%), "euthanizing" an ill relative (14%), and prisoner escape (11%). Ambient society violence (9%) and mentally unstable patients (4%) were comparatively infrequent. The most common victim was the perpetrator (45%). Hospital employees composed 20% of victims; physician (3%) and nurse (5%) victims were relatively infrequent. Event characteristics that distinguished the ED from other sites included younger perpetrator, more likely in custody, and unlikely to have a personal relationship with the victim (ill relative, grudge, coworker). In 23% of shootings within the ED, the weapon was a security officer's gun taken by the perpetrator. Case fatality inside the hospital was much lower in the ED setting (19%) than other sites (73%).

Conclusion: Although it is likely that not every hospital-based shooting was identified, such events are relatively rare compared with other forms of workplace violence. The unpredictable nature of this type of event represents a significant challenge to hospital security and effective deterrence practices because most perpetrators proved determined and a significant number of shootings occur outside the hospital building. [Ann Emerg Med. 2012;60: 790-798.]

Please see page 791 for the Editor's Capsule Summary of this article.

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INTRODUCTION

The workplace is a common site of hostilities, with approximately 2 million Americans falling victim to workplace violence each year.[1] In fact, homicide is one of the leading causes of job-related deaths in the United States.[2,3] There were 8,666 occupational homicides in the 14-year period from 1997 to 2010, the majority (79%) perpetrated by firearms.[4] Unfortunately, the health care setting is not immune to workplace violence.[5-11] The rate of assaults on health workers is 8 of 10,000 compared with 2 of 10,000 for private-sector industries.[5]

Perhaps the most feared form of assault is gun violence. Although hospital shootings are often high profile, attracting intense media coverage,[12] little is known about this particular form of violence in medical settings. After a recent shooting at our own institution, and because of the hospital staff's sense of vulnerability,[12] we sought to characterize and determine the extent of gun violence in US hospitals to help develop appropriate mitigation and response strategies.

Accordingly, we reviewed hospital-related shootings from 2000 to 2011 to determine circumstances of gun-related violence in hospitals and to profile shooters. To our knowledge, this is the first attempt to comprehensively review hospital-related shootings during any significant period.

MATERIALS AND METHODS

Using LexisNexis and public search engines (PubMed, Google, Netscape, and Bing), we conducted a search of all

Editor's Capsule Summary

What is already known on this topic

Hospitals have relatively high rates of workplace violence compared with other settings.

What question this study addressed

This 11-year review of news clips examined where in the hospital shootings occur, as well as perpetrator demographics and motivations.

What this study adds to our knowledge

The emergency department (ED) accounts for one third of shooting locations, and 50% of ED shootings involved security personnel firearms.

How this is relevant to clinical practice

Although hospital shootings are rare, security and enforcement personnel should adhere to safe carrying practices to minimize ED incidents.

newspaper articles and press releases published in the United States between January 1, 2000, and December 31, 2011, using the search terms "hospital shooting," "hospital violence," "assaults on healthcare providers," "shooting of healthcare workers," and "guns and hospitals" for each year of study. The resultant 9,360 headlines were reviewed for relevance by 2 reviewers (C.L.C. and J.G.K.).

Articles were included in the study if the shooting occurred at an acute care hospital or on its grounds and involved at least 1 injured person (victim or perpetrator). Shootings that occurred in private physician offices (off campus), off-campus ancillary care facilities, specialty hospitals (other than pediatrics), nursing homes, and assisted living facilities were excluded.

Data were extracted and independently characterized by 2 of the authors (C.L.C. and J.G.K.). When discrepancies could not be resolved, a third reviewer (G.D.K.) rendered the final determination. For each "shooting event," hospital information, specific event location(s), perpetrator and victim characteristics, outcome of injuries, and apparent motive were ascertained. Shootings were categorized according to a previously established classification based on the perpetrator's relation to the workplace.[13,14] To further this concept, we developed a motive classification. Within this rubric, *motive* was determined to be grudge-related if news reports clearly indicated a revenge basis, including intimate relation violence. Finally, we judged whether use of a magnetometer (metal detector) at an entrance could have prevented the violence. Shootings that occurred after peaceful entry into the hospital were generally considered to be preventable had the perpetrator been screened by a magnetometer. Individuals who rushed or stormed into the hospital, seized a weapon carried by security or police, were motivated by grudge, or initiated the shooting event outside the hospital were considered "determined" shooters, unlikely deterred by metal detectors.

Data were collated and aggregated by event characteristics. Shooting events were classified as occurring inside (ie, within the walls of the hospital) or outside (ie, hospital grounds, parking lot, and garages). Because we were particularly interested in the emergency department (ED) as a site, for purposes of analysis it was considered a distinct inside site. Overall and hospital bed size–specific incidences of hospital shooting events per 1,000 hospitals were estimated with total number of registered US hospitals from the 2009 American Hospital Association Survey.[15] Overall morbidity per 1,000,000 population as well as incidence of shooting events per 1,000,000 population by US region were calculated from US population estimates on January 1, 2006, by the US Census Bureau.[16] For each event, facility size was ascertained by data available through the Internet. Case fatality statistics were determined as appropriate.

Because the results represented the universe of data, standard statistical testing was generally not undertaken. χ^2 Tests were performed for the comparison of the events occurring in the ED proper versus those occurring elsewhere. Statistical significance is presented by the risk difference (RD) and its corresponding 95% confidence interval (CI). To put our results in context with those from other professional settings, the resultant data were compared with those publically available from the Department of Labor, Bureau of Labor Statistics.[4]

Because the data are publically accessible, the research was deemed exempt from institutional review.

RESULTS

For the 12-year study period, we identified 154 hospital-related shooting events (26.6 events per 1,000 hospitals) in 148 hospitals, affecting 235 victims (0.79 per 1,000,000 population). Five hospitals experienced more than 1 discrete event. All but 10 states experienced at least 1 hospital shooting event. Southern states proportionately experienced the most events (44%, or 0.63 event per 1,000,000 population), whereas the Northeast region had the least (15%, or 0.42 event per 1,000,000 population). The Midwest and West had 20% (0.47 event per 1,000,000 population) and 21% (0.47 event per 1,000,000 population), respectively. Five states, Florida, California, Texas, Ohio, and North Carolina, accounted for more than a third of the events. Shootings any given year ranged from 6 (in 2000) to 28 (in 2010) (Figure). Mean number of shootings in the latter 6 years was 16.7 compared with 9.0 in the first 6 years (rate ratio=1.9; 95% CI 1.3 to 2.6). However, shooting rates within hospital walls remained relatively steady during the 12 years (7.0 versus 8.2 per year; rate ratio=1.2; 95% CI 0.8 to 1.8), whereas external shootings increased markedly from 2.0 per year to 8.5 (rate ratio=4.3; 95% CI 2.3 to 8.3). Appendix E1 details representative examples of hospital shootings.

According to American Hospital Association data, 40% of US hospitals have 100 to 399 beds.[15] A majority of shootings

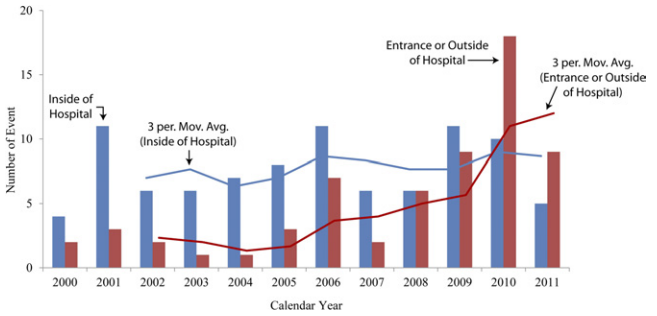

Figure. Distribution of hospital-based shootings in the United States by year: 2000-2011.

Table 1. Hospital characteristics of shooting events occurring in US hospitals, 2000 to 2011.

Characteristics and Categories	Total, %, N=154	Location of Event, %	
		Inside Hospital, N=91 (59%)	Outside Hospital, N=63 (41%)
Region of country			
Northeast	23 (15)	12 (13)	11 (17)
South	68 (44)	34 (37)	34 (54)
Midwest	31 (20)	21 (23)	10 (16)
West	32 (21)	24 (27)	8 (13)
Rural			
Yes	41 (27)	21 (23)	20 (32)
No	113 (73)	70 (77)	43 (68)
Hospital bed size (No. of beds)			
<100	20 (13)	11 (12)	9 (14)
100–399	81 (53)	51 (56)	30 (48)
≥400	53 (34)	29 (32)	24 (38)
Specific location			
ED	44 (29)	31 (34)	13 (21)*
Patient room	30 (19)	29 (32)	1 (2)
ICU	6 (4)	6 (7)	0 (N/A)
Office	6 (4)	6 (7)	0 (N/A)
Parking lot†	35 (23)	0 (N/A)	35 (56)
Other	33 (21)	19 (20)	14 (21)

N/A, Not applicable.
*Proximate to the ED (ambulance ramp, ED parking, outside walkway).
†Non-ED general parking lot.

(53%; 34.8 events per 1,000 hospitals) occurred at these facilities. Nonetheless, large hospitals (≥400 beds), composing just 9% of all hospitals, had the highest incidence (99.8 events per 1,000 hospitals). Small hospitals, composing 51% of all hospitals, had the lowest incidence (6.7 events per 1,000 hospitals). Of the 154 events, 91 (59%) occurred inside the hospital building (Table 1). Of these, 31 (34%) occurred inside the ED and another 29 (32%), in patient rooms. (Four of the events classified as internal were multiple shootings occurring both inside and outside the facility.) Of the 63 (41%) events occurring outside on hospital grounds, 35 (56%) occurred in parking lot areas and 13 (21%), near the ED (ambulance ramp, ED parking, and outside walkway). Thus, overall, the ED accounted for almost a third of all events.

A majority (91%) of shooters were men, representing all ages, including the elderly (Table 2). Most perpetrators had a personal association with their victims: 32% were current or estranged intimate relations, 25% were current or former patients, and 5% were current or former employees. In only 13% of events was the association not obvious. Most of the events involved a determined shooter with a specific target. The most frequent ascribed motives were grudge or revenge (27%), suicide (21%), or ending the life of an ill hospitalized relative (14%). Escape attempts by patients in police custody accounted for 11% of the shooting events. Societal violence (9%) and mentally unstable patients (4%) were relatively infrequent causes. In 26 (18%) cases, the perpetrator did not bring his or her own firearm (Table 3). In fact, in 13 (8%) events, the shooting event was initiated by the perpetrator's taking a security or police officer's gun. In the other cases, security shot the perpetrator for other threats, such as wielding a knife. In 2 cases, the perpetrators were hospital security personnel themselves.

The majority (61%) of events had only 1 victim, although 10% had 3 or more victims. Of the 235 victims, 129 (55%) were innocent victims (ie, excluding the perpetrator). Hospital staff were relatively infrequent victims, with physicians (3%) and nursing staff (5%) comprising a particularly small proportion (Table 4). Most likely killed or injured were the perpetrators themselves (45%), followed by patients (13%). Of the 106 perpetrators who were themselves shot, 84 (79%) died, 59 by suicide (Tables 2 and 4).

Case fatality rate among "innocent" victims was 55% overall (Table 5). Excluding the death of 22 ill relatives, the case fatality rate was 46%. The case fatality rate among injured perpetrators was 85% overall, and excluding suicides, it was 65%.

To place the rate of hospital-associated shootings in context, comparisons of other work-setting–related homicides for 1997 to 2010, derived from Bureau of Labor Statistics data, are shown in Table 6.[4] General medical and surgical hospitals experienced 21 homicides, similar to the rate in lawyers' offices (15) and post offices (18). Hotels (72), convenience stores (271), taxi services (286), and local government (461) were places of considerably higher rates of work-related homicides.

Authors judged that only 30% to 36% of events were likely preventable by use of a metal detector (Table 3). When considering only those shootings occurring inside the hospital, less than half (49%) were judged as likely preempted by magnetometer screening, although another 10% were conceded as possibly preventable.

There were a few characteristics that distinguished ED shootings compared with those occurring elsewhere (Tables 2 and 3). In the ED, the perpetrators were younger (<40 years) (61%) compared with those in other inside sites (21%) (RD 30%; 95% CI 11% to 49%) and none of the shootings targeted an ill relative, unlike in other inside settings (35%) (RD –18%; 95% CI –25% to –11%). Of the ED shootings, 29% were related to incidents involving individuals in custody compared with 5% for all other sites (RD 24%; 95% CI 8% to 41%)

Table 2. Characteristics of shooting-event perpetrators in US hospitals, 2000 to 2011.

Characteristics and Categories	Total, %, N=154	Location of Event, %		
		Inside Hospital, ED Sites, N=31 (20%)	Inside Hospital, Non-ED Sites, N=60 (39%)	Outside Hospital, N=63 (41%)
Age, y				
18–29	27 (19)	11 (35)	4 (7)	12 (22)
30–39	30 (21)	8 (26)	8 (14)	14 (25)
40–49	22 (15)	7 (23)	5 (9)	10 (18)
50–59	23 (16)	3 (10)	10 (18)	10 (18)
60–69	13 (9)	1 (3)	6 (11)	6 (11)
70–79	16 (11)	0	15 (27)	1 (2)
≥80	11 (8)	1 (3)	8 (14)	2 (4)
Unknown	12 (N/C)	0 (N/C)	4 (N/C)	8 (N/C)
Sex				
Male	138 (91)	28 (90)	53 (90)	57 (92)
Female	14 (9)	3 (10)	6 (10)	5 (8)
Unknown	2 (N/C)	0 (N/C)	1 (N/C)	1 (N/C)
Motive				
Grudge	41 (27)	1 (3)	16 (27)	24 (38)
Suicide	32 (21)	7 (23)	11 (18)	14 (22)
Ill relative	22 (14)	0	21 (35)	1 (2)
Escape attempt	17 (11)	11 (35)	3 (5)	3 (5)
Social violence	14 (9)	2 (6)	2 (3)	10 (16)
Mentally unstable patient	6 (4)	4 (13)	1 (2)	1 (2)
Unclear	22 (14)	6 (19)	6 (10)	10 (16)
Category of workplace violence[3,13,14]				
I. Criminal behavior	8 (5)	2 (6)	0	6 (10)
II. Customer				
Patients against others	38 (25)	13 (42)	17 (28)	8 (13)
Patients in custody	15 (10)	9 (29)	3 (5)	3 (5)
III. Coworker	7 (5)	0	5 (8)	2 (3)
IV. Personal relationship	49 (32)	1 (3)	25 (42)	23 (37)
Unclassified: self as victim	17 (11)	3 (10)	2 (3)	12 (19)
Unknown	20 (13)	3 (10)	8 (13)	9 (14)
Disposition of perpetrator				
Suicide	59 (38)	5 (16)	34 (57)	20 (32)
Arrested	47 (31)	8 (26)	16 (27)	23 (37)
Shot and killed	28 (18)	14 (45)	5 (8)	9 (14)
Shot and arrested	12 (8)	4 (13)	4 (7)	4 (6)
Other	1 (1)	0	0	1 (2)
Unknown	7 (5)	0	1 (2)	6 (10)

N/C, Not calculated.

(Table 2). Grudge motive (3%) was seldom encountered in the ED compared with other inside hospital sites (27%) (RD –23%; 95% CI –36% to –11%) and outside hospital sites (38%) (RD –35%; 95% CI –48% to –21%) (Table 2). Similarly, having an established relationship with the victim(s) was also seldom encountered in the ED (3%) compared with both inside (42%) (RD –38%; 95% CI –52% to –25%) and outside the hospital (37%) (RD –33%; 95% CI –47% to –20%). Fifty percent of the guns used in the ED were not brought by the perpetrator but rather involved security personnel's firearms. In contradistinction, the perpetrator brought a weapon 91% (RD 42%; 95% CI 22% to 61%) and 90% (RD 40%; 95% CI 21% to 60%) for both other inside and outside sites, respectively (Table 3). In fact, the perpetrator's taking of a gun initiated 23% of ED events. In addition, a magnetometer was judged less likely to prevent the event in the ED (68%) compared with other inside sites (18%) (RD 40%; 95% CI 30% to 69%). Finally, perpetrators in the ED were less likely to commit suicide (16%) compared with those in other inside hospital sites (57%) (RD –41%; 95% CI –59% to –23%) and more likely to be shot and killed in proximate time (45% versus 8%; RD 37%; 95% CI 18% to 56%). The case fatality rate among innocent victims was lower in the ED (19%) compared with other inside areas (73%) (RD –55%; 95% CI –75% to –34%) or with outside the hospital (52%) (RD –36%; 95% CI –56% to –15%) (Table 5).

Table 3. Profile of shooting events occurring in US hospitals, 2000 to 2011.

Characteristics and Categories	Total, %, N=154	Location of Event, %		
		Inside Hospital, ED Sites, N=31 (20%)	Inside Hospital, Non-ED Sites, N=60 (39%)	Outside Hospital, N=63 (41%)
Source of gun				
Perpetrator	127 (82)	15 (50)	55 (91)	57 (90)
Security/police	26 (18)	15 (50)	5 (9)	6 (10)
Unclear	1 (N/C)	1 (N/C)	0 (N/C)	0 (N/C)
Police/security gun involvement				
Used on perpetrator	25 (16)	13 (42)	7 (12)	5 (8)
Taken by perpetrator	13 (8)	7 (23)	4 (7)	2 (3)
Security as perpetrator	2 (1)	0	1 (2)	1 (2)
No	114 (74)	11 (35)	48 (80)	55 (87)
Potential of magnetometer to prevent shooting				
Likely prevented	46 (30)	3 (10)	42 (70)	1 (2)
Possibly prevented	9 (6)	3 (10)	6 (10)	0
Not likely prevented	94 (61)	21 (68)	11 (18)	62 (98)
Not sure	5 (3)	4 (13)	1 (2)	0

Table 4. Profile of individuals wounded and killed during shootings in US hospitals, 2000 to 2011.

Victim Characteristics and Categories	Total, %, N=235	Location of Event, %		
		ED, N=40 (17%)	Inside Hospital, Non-ED Sites, N=97 (41%)	Outside Hospital, N=98 (42%)
Hospital staff				
Total	48 (20)	8 (20)	16 (16)	24 (24)
Nursing staff	12 (5)	3 (8)	2 (2)	7 (7)
Physician	8 (3)	1 (3)	6 (6)	1 (1)
Pharmacist	4 (2)	0	4 (4)	0
Other	24 (10)	4 (10)	4 (4)	16 (16)
Other				
Total	187 (80)	32 (80)	81 (84)	74 (76)
Perpetrator is victim	106 (45)	24 (60)	46 (47)	36 (37)
Patients	31 (13)	1 (3)	27 (28)	3 (3)
Visitors	18 (8)	0	4 (4)	14 (14)
Security/police/guard	12 (5)	7 (18)	3 (3)	2 (2)
Other/unclear	20 (9)	0	1 (1)	19 (19)

LIMITATIONS

There is at least 1 potential limitation related to the data set. It is possible that some events remote from 2011 are no longer accessible, resulting in underreporting for earlier years. However, to assess this potential we rechecked each Uniform Resource Locator address link for each shooting at least 1 year beyond the original discernment. Each link remained fully functional. Apart from breach in discernment associated with time, the potential that not all hospital-related shootings were reported may also lead to underascertainment. Having used a similar search methodology to ours, Wintemute et al,[17] studying stray-bullet injuries, provided an excellent discussion on the potential for underascertainment. As they observed, events involving firearms, unusual or rare events, and shootings occurring outside major metropolitan centers—conditions generally fulfilled by the circumstances of hospital-associated shootings—are more likely to be reported.[18-20] In addition, as noted, overall trends and the order of magnitude of the data are consistent with Bureau of Labor Statistics data.[4] There may have been some misclassification of hospital size because data acquired through the Internet were current, and in some cases hospital size may have been larger or smaller for some events ascertained in the past. Finally, our novel classification of motive as a means to define shooting intent depended on gleanings from news sources and has not been validated.

DISCUSSION

Workplace violence is a national problem and unfortunately reflects the culture of violence in the US population. According to United Nations statistics, the United States ranks first in murders and assault among rich, industrialized western countries.[21,22] Health care settings are not exempt and in fact appear to have higher rates of workplace violence than many other settings.[5] Recently, The Joint Commission noted

Table 5. Case fatality of individuals wounded and killed during shootings in US hospitals, 2000 to 2011.

Victim Characteristics and Categories	Total, %, N=235	Case Fatality, %
Innocent victims	129	55
Perpetrators (as victims)	106	85*
Hospital staff		
Total	48 (20)	50
Nursing staff	12 (5)	58
Physician	8 (3)	38
Pharmacist	4 (2)	100
Other	24 (10)	42
Other		
Total	187 (80)	73*
Perpetrator is victim	106 (45)	85*
Excluding suicide	40 (17)	65*
Patients	31 (13)	81
Visitors	18 (8)	50
Security/police/guard	12 (5)	42
Other/unclear	20 (9)	40

*Excluding 7 perpetrators with disposition of "unknown."

Table 6. Selected comparison of occupational homicides by industry (1997 to 2010).*†

Industry	Occupational Homicides
General medical and surgical hospitals	21
Lawyers' offices	15
Postal service	18
Real estate agent offices	29
Ambulatory health care	59
Hotels	72
Motor vehicle and parts dealers	101
Manufacturing	135
Construction	137
Convenience stores	271
Taxi and limousine service	286
Local government	461

*Source: Bureau of Labor Statistics. Available at: http://www.bls.gov/iif/os-hwc/cfoi/work_hom.pdf.
†Data include all occupation-related homicide events. Aggregate data revealed that approximately 79% of such violent acts involve firearms.

significant increases in assault, rape, and homicide in hospital settings from 2006 to 2009.[23] Our data also revealed an increase in hospital-related shootings in the last few years, but all of the increase can be attributed to shootings outside the hospital itself (Figure).

Our data indicate that approximately 3% of registered US hospitals experienced at least 1 shooting event with a victim (in or on hospital grounds) during the 12-year period studied, a rate of 0.2% a year. The Department of Labor, Bureau of Labor Statistics indicated that less than 2% of workplace shootings involve the health care sector,[4] a percentage that is similar to that of college and university campuses that reported about 1.5% "active shooter on campus" incidents within a 5-year period[24] and is otherwise lower than the percentage of lightning-related deaths.[25]

Our data appear to be in keeping with those reported by the Bureau of Labor Statistics (Table 6).[4] We found 48 hospital staff victims, of whom 24 can be classified as homicide. By comparison, the Bureau of Labor Statistics data for the 14-year period 1997 to 2010 noted only 21 health worker homicides in "general medical and surgical hospitals." Of these, only 79% are estimated to be related to shootings, according to aggregate Bureau of Labor Statistics data. Thus, we believe we have a reliable data set. Further, according to the Bureau of Labor Statistics data, it appears that hospitals experience the lowest number of occupational homicides (Table 6), similar to that of law offices.[4] We also attempted to crosscheck our data with the National Violent Death Reporting System.[26] However, only 16 states are participating (2 more recently added) and the data include deaths only. Publically available data lump hospitals as "commercial area (nonrecreational), including medical service area, farm, industrial, or construction area."[26] Although hospitals do have a specific code and are potentially available by special request, they are coded with "medical facility" and "nursing homes."[27] Finally, the National Violent Death Reporting System warns that the data are not nationally representative.

Our overall case fatality rate was 68% (57% with suicides excluded). By comparison, Wintemute et al,[17] reporting on stray-bullet shootings in the United States between 2008 and 2009, reported a case fatality rate of 20.5%. They also cited national data indicating a 20.6% case fatality in 2007. According to the Centers for Disease Control and Prevention, in 2001 the case fatality rate for unintentional, intentional, and self-harm from firearm injuries was 8.4%, 24.7%, and 85%, respectively.[28] States may differ in their case fatality rates because data provided by Florida appear to suggest rates of 54% to 63% when the denominator includes survivors transported to the hospital.[29] Our finding of a relatively high case fatality rate of 55% among innocent victims may be related to several factors, including the potential for close proximity of the perpetrator to the victim, the assumed lack of anticipation by victims in most cases, the frailty of ill victims, and the determination of the shooter.

Established classification of workplace violence does not appear to adequately describe hospital shooting–related violence (see Appendix E1).[3,13,14] Accordingly, we advance a further classification based on motive. Our data indicate that health care providers and employees are unlikely to be victims of indiscriminate violence. In fact, unlike those in education campuses, most hospital shootings have an intended specific target. In our series, almost 75% of shooting events reported as occurring within hospitals were highly targeted (grudge, suicide, ill relative, escape attempt). Only about a fifth of all victims were employees, and few of these were physicians or nurses.

However, the perception of workplace violence risk in health care settings is often heightened. For example, surveys reveal that the perceived risk of an active shooter on campus was 3 times the actual risk whether the campus experienced a previous

event or not.[24] There is evidence that risk misperception results from acute stress disorder, related to knowledge that such shootings occur.[30] We postulate that this may be a factor in hospital shootings as well. This sentiment of high vulnerability to ambient societal gun violence was frequently expressed at our own town hall meetings after the Hopkins shooting.[31]

Although societal violence as a cause of workplace violence is the norm in other workplace settings,[3,32] our data should go a long way toward dispelling this fear. The National Institute of Occupational Safety and Health observed that 85% of workplace homicides are categorized as criminal intent, whereas our data indicated the likelihood of a previous relation or association.[3] Traditional predictors of violence such as inner-city location or dangerous neighborhoods were not apparent in our study. Hospital size was not particularly a factor when controlling for total beds.[33] The risk appears normalized for the population traffic (staff, visitors, patients) likely involved in hospital activities. Similarly, 9 of 10 states with the most shootings are in the top 10 populous states (data not shown). In fact, few patterns could be discerned to help profile vulnerable sites and situations, including traditional predictors such as drug use, homelessness, and psychiatric disorder.[6]

There were some distinctions in characteristics of ED shootings. Perpetrators were proportionately younger overall, likely reflecting the virtual absence of shooting of ill relatives in this setting. In the inpatient settings, these types of shootings were often carried out by distraught older relatives, the majority of whom were spouses. Many such individuals committed (or attempted) suicide themselves. The comparatively low case fatality rate of 19% among innocent victims in the ED setting is difficult to explain but may be related to the more chaotic and possibly spontaneous nature of events in this setting, which has fewer perpetrators in the premeditated determined shooters category. Of particular concern is the person in custody in the ED who is being guarded or watched by armed security personal. A high proportion of ED shootings (23%) were related to this circumstance. There are surely many more such unreported "near-miss altercations" without any shots being fired. During the 1990s, there were 57 police officers killed by their own weapons, which were taken by perpetrators.[34] Of all the circumstances defining shooting risk in the hospital setting, this represents a true opportunity for mitigation by strict adherence to accepted safe security practice. However, police and prison officials are loath to relinquish their weapons while on duty, for understandable reasons, and strict policies for handling firearms in the presence of patients in custody or those with altered sensorium do exist. It has been suggested that personalized or safe handguns ("smart gun" or "personalized gun") be used by security personnel. Such guns depend on proximate biometrics to render a firearm useable. However, both the National Rifle Association and the handgun ban organization Violence Policy Center oppose their development and use, the former because of ownership rights and lack of 100% reliability[35,36] and the latter because they claim that even more guns would be sold on this basis.[37]

Whenever a shooting occurs in a hospital, personnel tend to pressure the administration to install magnetometers (metal detectors).[38] We judged that less than half of the instigators' weapons used inside the institution may have been discovered through this method. Most security experts believe that widespread-use magnetometers are impractical in the hospital setting. Unlike courthouses, federal buildings, and airports, ingress and egress cannot be restricted in most hospitals to just 1 or even a few portals. In addition, magnetometers may provide a false sense of security because, despite the magnetometers, weapons are still readily introduced into the hospital setting.[39] Furthermore, as the data show, armed guards manning the magnetometers may be the source of weaponry used in hospital-related shootings.

Means to prevent workplace violence specific to health care settings have been published by the US Department of Labor.[40] Although general guidelines are useful, hospital shootings do not reveal dominant patterns or factors that readily point to security remedies. According to the risk of general assault, certain areas and disciplines in health care are considered at higher risk of workplace violence, such as EDs, psychiatric and geriatric wards, centers, nursing homes, and ICUs.[10,41] Our data point only to the ED as a possible site with higher risk for shootings. Standard hospital patient rooms, in which many shootings occur, are not true workplace violence events because many of the shootings targeted very ill relatives. One other surprising risk for victimization recently identified is the employees themselves. There is evidence that among nursing staff, less experienced workers and staff who themselves have been victims of abuse are at greater risk of being victims of violence in the health setting.[41]

In summary, hospital shootings are rare compared with other forms of workplace violence and appear difficult to profile. Most involve a determined shooter against a specific target; hence, we advance a motive classification. Cities and neighborhoods with high rates of violence do not appear to be at any increased risk. Although security steps have been detailed elsewhere,[31,40] impenetrable hospital security in an open society represents a particular challenge,[23] and zero risk is not achievable.

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IMAGES IN EMERGENCY MEDICINE

(continued from p. 692)

DIAGNOSIS:

Morgagni's hernia with intestinal obstruction. Morgagni's hernia, first described by the anatomist Morgagni in 1761, represents 2% to 5% of diaphragmatic congenital hernias. Its location is parasternal through the sternocostal hiatus of the diaphragm (foramina of Morgagni) and more frequently right sided (90%) because of the presence of the pericardial sac on the left side.[1] The diagnosis is more common in infants who may present early in life with respiratory distress. In adults, the hernia is usually discovered incidentally because only 30% of patients are symptomatic due to intestinal involvement (occlusive symptoms) or respiratory dysfunction.[2] Morgagni hernias account for 3% of total intestinal obstructions.[3] Symptomatic adult patients are generally managed surgically. Laparoscopic treatment is a potential approach to the treatment of a Morgagni's hernia, although a transabdominal approach is recommended when the patient has findings suggesting intestinal strangulation.[4]

In this case, the presence of bowel within the chest cavity without evidence of preceding traumatic injury supported the diagnosis of a congenital hernia. This patient's presentation, including vomiting and radiographic air-fluid levels, suggested obstruction of herniated intestinal contents and prompted immediate consultation for surgical intervention.

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Appendix E1. Selected examples of hospital shootings.

Grudge Motive

Cleveland, OH, December 2001: A 40-year-old man attacked his 34-year-old estranged wife and her 36-year-old ex-husband as she was exiting his car to report to work as a nurse. After opening fire on the ex-husband and hitting him in the forearm, he then followed his fleeing wife into the hospital lobby and shot her in the head, killing her. It was later determined that the gunman believed his wife was trying to reconcile with her ex-husband.

Columbus, GA, May 2008: A 63-year-old man entered the ICU at Doctors Hospital, where his mother had died 4 years earlier, and confronted a nurse whom he blamed for his mother's death. He shot the nurse twice and then during his escape shot a second employee as he was exiting the ICU. As the man fled to the parking lot, he shot a visitor exiting his car. Policemen then trapped the man in the parking lot and fatally shot him as he drew a gun on them.

Jacksonville, FL, June 2008: A 68-year-old man confronted his ex-girlfriend and their 11-year-old son as they were leaving the ED of Baptist Medical Center and shot them both. He then turned the gun on himself and committed suicide. The estranged couple had been in a lengthy custody battle over the son. The child survived the shooting, but his mother died overnight.

Long Beach, CA, April 2009: A 50-year-old pharmacy technician shot to death the executive director of his pharmacy and another one of his supervisors before placing the gun to his own head and killing himself. Coworkers speculated that the gunman feared he was about to be laid off from his job.

In Custody, Unsecured Gun

Langhorne, PA, September 2005: A 38-year-old man was brought to the ED after being charged with driving under the influence of alcohol because of blood and urine testing. While in the ED, he took a gun from an unsecured holster of one of the officers and shot him in the chest, accidently shooting himself in the hand as well. Next, the prisoner turned and shot a technician in the shoulder and then shot a second police officer 3 times, killing him. Finally, he went back to the first officer to shoot him again but the gun was empty. He fled the scene but was captured while hiding in the backseat of a parked car in the hospital garage.

Baltimore, MD, January 2008: A prisoner admitted to the hospital overpowered 4 correctional officers and took 2 of their guns. He fired at his shackles before fleeing. He took a hospital security guard hostage as he made his way to the lobby and then fled. Outside, he hijacked a car in the parking lot, shooting the driver in the head (the driver survived). He was killed later during a shoot-out with the police.

Suicide Motive

Delaware, OH, May 2000: A 46-year-old man walked into a hospital, handed the clerk an envelope, said, "Don't worry, I won't hurt you," placed a .22-caliber handgun to his head, and shot himself. Inside the envelope was a note stating the man's desires to have his organs donated. He remained in critical condition for 3 days until he died. His eyes and some internal organs were donated to transplant patients, hospital officials stated.

Ill Relative

Rockdale, TX, December 2011: A 77-year-old man brought a .357 Magnum revolver into the hospital room of his 78-year-old wife, who had dementia, was bedridden, and could no longer care for herself. He shot her once in the head and then fatally shot himself in the head. She ultimately died.

Psychiatric Derangement

Vinita, OK, October 2001: A 48-year-old man with paranoid schizophrenia burst into the ED at Craig General Hospital and fired 6 rounds into a 45-year-old nurse, killing her. Officers responding to the scene found the man on top of a car in the parking lot, reloading his weapon. As the man aimed his gun on the officers, 2 of them shot and killed him. It was reported that the shooter had been living as a resident of a mental health facility before the shooting and was believed to have been noncompliant with his medication.

Multiple Motives (Grudge, Ill Relative, Suicide)

Baltimore, MD, September 2010: A 50-year-old man who became distraught after hearing about the unfavorable prognosis following surgery on his elderly terminally ill mother drew a concealed handgun and fired on his mother's surgeon in the hallway of hospital ward. The shooter barricaded himself and his mother in her hospital room, where he fatally shot his mother and then committed suicide. The surgeon survived.