Importance
Domestic violence is an extremely underreported crime and a growing social problem in the United States. However, the true burden of the problem remains unknown.

Objective
To assess the reported prevalence of domestic violence among trauma patients.

Design, Setting, and Participants
A 6-year (2007-2012) retrospective analysis of the prospectively maintained National Trauma Data Bank. Trauma patients who experienced domestic violence and who presented to trauma centers participating in the National Trauma Data Bank were identified using International Classification of Diseases, Ninth Revision diagnosis codes (995.80-995.85, 995.50, 995.52-995.55, and 995.59) and E codes (E967.0-E967.9). Patients were stratified by age into 3 groups: children (<18 years), adults (19-54 years), and elderly patients (=55 years). Trend analysis was performed on April 10, 2014, to assess the reported prevalence of domestic violence over the years.

Participants
Trauma patients presenting to trauma centers participating in the National Trauma Data Bank.

Main Outcomes and Measures
To assess the reported prevalence of domestic violence among trauma patients.

Results
A total of 16,575 trauma patients who experienced domestic violence were included. Of these trauma patients, 10,224 (61.7%) were children, 5,503 (33.2%) were adults, and 848 (5.1%) were elderly patients. The mean (SD) age was 15.9 (20.6), the mean (SD) Injury Severity Score was 10.9 (9.6), and 8,397 (50.7%) were male patients. Head injuries (46.8% of patients) and extremity fractures (31.2% of patients) were the most common injuries. A total of 12,515 patients (75.1%) were discharged home, and the overall mortality rate was 5.9% (n = 980). The overall reported prevalence of domestic violence among trauma patients was 5.7 cases per 1000 trauma center discharges. The prevalence of domestic violence increased among children (14.0 cases per 1000 trauma center discharges in 2007 to 18.5 cases per 1000 trauma center discharges in 2012; P = .001) and adults (3.2 cases per 1000 discharges in 2007 to 4.5 cases per 1000 discharges in 2012; P = .001) over the 6-year period and remained unchanged for elderly patients (0.8 cases per 1000 discharges in 2007 to 0.96 cases per 1000 discharges in 2012; P = .09). On subanalysis of adults and elderly patients, the prevalence of domestic violence increased among both female (4.6 cases per 1000 discharges in 2007 to 5.3 cases per 1000 discharges in 2012; P = .001) and male patients (1.5 cases per 1000 discharges in 2007 to 2.8 cases per 1000 discharges in 2012; P = .001).

Conclusions and Relevance
Domestic violence is prevalent among trauma patients. Over the years, the reported prevalence of domestic violence has been increasing among children and adults, and continues to remain high among female trauma patients. A robust mandatory screening for evaluating domestic violence among trauma patients, along with a focused national intervention, is warranted.
buse in its many forms is a global problem, cutting across the boundaries of age, sex, culture, religion, and nationality. The gravity of the problem can be estimated by the fact that it is the most common mechanism of injury among women, responsible for more injuries than motor vehicle accidents and other assaults combined. Although presumed to be a problem in underdeveloped countries, domestic violence still remains a significant health care burden in the United States.2

Domestic violence encompasses a wide variety of maltreatment, including emotional, physical, sexual, and verbal abuse, as well as neglect and abandonment. In the United States, national estimates suggest a high prevalence of domestic violence, with 1.5 million female and 830,000 male persons who experience domestic violence annually.3-5 According to the US Department of Health and Human Services, 4 children die each day as a result of child abuse.6 In addition, 14% of older adults experience financial exploitation or some kind of physical, psychological, and sexual abuse each year.7

Trauma surgeons and emergency physicians are at the forefront of this problem. They are among the first persons who can identify and intervene in this social and moral dilemma. However, recent studies have shown gaps in the knowledge among attending physicians regarding the true incidence of this problem.8 The aim of our study was to assess the national prevalence and trends of domestic violence among trauma patients.

**Methods**

We performed a 6-year (2007-2012) retrospective analysis of the National Trauma Data Bank (NTDB), version 7.2. The NTDB is the largest collection of trauma index cases and is maintained by the American College of Surgeons. The NTDB contains more than 1.8 million patients, with contributions from more than 900 trauma centers across the United States. Our study was exempt from approval by the institutional review board of the University of Arizona, Tucson.

To ensure reporting of incidents from a homogenous population, we included only those facilities that were consistently reporting data during the whole study period. After adjusting for the facilities, patients who experience domestic violence were identified using *International Classification of Diseases, Ninth Revision* diagnosis codes (eTable 1 in the Supplement). We abstracted the following data points from the NTDB: demographics, vital statistics on presentation, hospital and intensive care unit length of stay, and in-hospital mortality. Injury characteristics were abstracted using the Injury Severity Score and the Abbreviated Injury Scale score.

For the purpose of our study, we defined domestic violence as child abuse, intimate partner violence (IPV), and elder abuse. Perpetrators of violence were defined as a significant male relative (father, stepfather, boyfriend, husband, or ex-spouse), significant female relative (mother, stepmother, girlfriend, wife, or ex-spouse), other relative (children, sibling, or grandparent), other nonrelative (other specified person or nonrelated caregiver), or unspecified person.

Patients were then stratified into 3 age groups: children (<18 years), adults (19-54 years), and elderly patients (≥55 years). Our primary outcome measure was to assess the reported prevalence of domestic violence among trauma patients. Our secondary outcome measures were to assess the trends of reported prevalence of domestic violence overall and in age- and sex-based subsets of the trauma patient population.

Data are presented as mean (SD) values for continuous variables, as proportions for nominal variables, and as median (interquartile range) values for ordinal variables. We performed the t test to assess the difference between the 2 groups for parametric variables and the Mann-Whitney U test for nonparametric variables. A χ² test was performed to compare differences between the 2 groups for ordinal and nominal variables. The missing data on vital statistics and injury characteristics were accounted for by using multiple imputations and the Markov chain Monte Carlo method. For data analysis, we used the statistical package for social sciences software (SPSS, version 20.0; IBM Inc). P < .05 was considered statistically significant.

**Results**

**Study Population**

A total of 2,910,122 trauma cases from 370 consistently reporting facilities were included in the analysis. The mean (SD) age was 37.5 (32.8) years, 64.0% were male, 20.8% were children, 49.8% were adults, and 29.3% were elderly patients.

**Domestic Violence**

A total of 16,575 patients were identified who experienced domestic violence. The mean (SD) age was 15.9 (20.6) years, the median Injury Severity Score was 9 (interquartile range, 4-17), 8397 (50.7%) were male, 10,224 (61.7%) were children, 5503 (33.2%) were adults, and 848 (5.1%) were elderly.

Black and Hispanic patients were more likely to have experienced domestic violence (26.2% of black patients and 15.2% of Hispanic patients) than other traumatic events (14.1% of black patients and 10.9% of Hispanic patients) (P < .001), whereas white patients were less likely to have experienced domestic violence (47.5% of white patients) than other traumatic events (66.9% of white patients) (P = .001) (Table 1). The most common perpetrator of violence was a significant male relative (38%), followed by a significant female relative (11%) and other relatives (8%) (eTable 2 in the Supplement). Compared with patients who experienced other traumatic events, patients who experienced domestic violence were younger (mean [SD] age, 16 [21] years for patients who experienced domestic violence vs 38 [31] years for patients who experienced other traumatic events; P < .001) and more often female (49% experienced domestic violence vs 37% experienced other traumatic events; P < .001).

During the study period, the overall prevalence of domestic violence was 5.7 cases per 1000 trauma center discharges. We observed a linear increase in the reported incidence of domestic violence over the years (Figure 1). A total of 12,515 patients (75.1%) were discharged home, and the overall mor-

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The mortality rate was 5.9% (n = 980). The mortality rate was higher among children than among adults and elderly patients (8.6% vs 1.2% vs 4.1%; P = .001). There was no difference in mortality between male and female patients (6.3% vs 5.7%; P = .10). On subanalysis of the adult population, there was still no difference in mortality between male and female patients (1.2% vs 1.7%; P = .20) (Table 2).

### Subanalysis Based on Age

#### Children
A total of 10,224 children who experienced domestic violence were identified. Of these children, 7056 (69.0%) were infants, 6134 (60.0%) were male, the mean (SD) age was 3.5 (1.5) years, and the median Injury Severity Score was 14 (interquartile range, 4-17). Comparing children who experienced domestic violence with children who experienced traumatic events other than domestic violence, we found that male patients were more likely than female patients to have experienced domestic violence (60.0% vs 58.0%; P = .001). The most common perpetrator of violence among children was a significant male relative (30%), followed by a significant female relative (9%) and other nonrelatives (8.6%) (Table 2).

Of the 10,224 children who experienced domestic violence, 4856 (47.5%) were white, 2454 (24.0%) were black, and 1738 (17.0%) were Hispanic. Black and Hispanic children more frequently experienced domestic violence (24.0% of black children and 17.0% of Hispanic children) than other traumatic events (15% of black children and 13% of Hispanic children) (P = .001), whereas white children were less likely to have experienced domestic violence than other traumatic events (47.5% vs 62%; P = .001). During the study period, the overall prevalence of child abuse was 17 cases per 1000 trauma center discharges, with an increasing trend over the years (Figure 2).

#### Adults
A total of 5503 adult patients who experienced domestic violence were identified. Of these adult patients, 3467 (63.0%) were female, the mean (SD) age was 35 (10) years, and the median Injury Severity Score was 5 (interquartile range, 1-10). Comparing adult patients who experienced domestic violence with adult patients who experienced traumatic events other than domestic violence, we found that female patients were more likely to have experienced domestic violence (64% vs 26%; P = .001). The most common perpetrator of violence was a significant male relative (84.5%), followed by a significant female relative (42.1%) and other relatives (21%) (Table 2).
were more likely to have experienced domestic violence (31.0% of black adults and 13.0% of Hispanic adults) than other traumatic events (19% of black adults and 12% of Hispanic adults) \( (P = .001) \), whereas white adult patients were less likely to have experienced domestic violence than other traumatic events (45.0% vs 59%; \( P = .001 \)).

Over the study period, the rate of domestic violence among adult trauma patients was 3.7 case per 1000 trauma center discharges. We observed an increasing trend in domestic violence among adult trauma patients over the years (Figure 2). On subanalysis of sex, the rate of domestic violence among adult female trauma patients was 5 cases per 1000 trauma center discharges, and there was an increasing trend over the years. The prevalence of domestic violence among male trauma patients was 1.8 cases per 1000 trauma center discharges with an increasing trend (Figure 3).

### Table 2. Outcomes of Trauma Patients Who Experienced Domestic Violence and Presented to Trauma Centers Participating in the NTDB

<table>
<thead>
<tr>
<th>Variable</th>
<th>NTDB Sample (n = 4 146 428)</th>
<th>Patients Who Experienced Domestic Violence Study Population (n = 16 675)</th>
<th>Children (n = 10 224)</th>
<th>Adults (n = 5503)</th>
<th>Elderly (n = 848)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length of stay, median (IQR), d</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hospital</td>
<td>3 (1-6)</td>
<td>3 (2-7)</td>
<td>4 (2-8)</td>
<td>2 (1-4)</td>
<td>4 (2-7)</td>
</tr>
<tr>
<td>ICU</td>
<td>2 (1-5)</td>
<td>3 (2-6)</td>
<td>3 (2-8)</td>
<td>2 (1-4)</td>
<td>3 (2-6)</td>
</tr>
<tr>
<td>Discharge disposition, No. (%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Home</td>
<td>2 533 061 (61.1)</td>
<td>12 515 (75.1)</td>
<td>7790 (76.2)</td>
<td>4215 (76.6)</td>
<td>510 (60.1)</td>
</tr>
<tr>
<td>Rehabilitation</td>
<td>291 935 (7.0)</td>
<td>782 (4.7)</td>
<td>490 (4.8)</td>
<td>132 (2.4)</td>
<td>60 (7.1)</td>
</tr>
<tr>
<td>Skilled nursing facility</td>
<td>373 513 (9.0)</td>
<td>296 (1.8)</td>
<td>102 (1.0)</td>
<td>66 (1.2)</td>
<td>128 (15.1)</td>
</tr>
<tr>
<td>Mortality</td>
<td>121 380 (2.9)</td>
<td>980 (5.9)</td>
<td>879 (8.6)</td>
<td>66 (1.2)</td>
<td>35 (4.1)</td>
</tr>
<tr>
<td>Insurance status, No. (%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Medicare/Medicaid</td>
<td>1 261 129 (30.4)</td>
<td>9296 (55.7)</td>
<td>7054 (69.0)</td>
<td>1760 (32.0)</td>
<td>482 (56.8)</td>
</tr>
<tr>
<td>Private</td>
<td>1 059 514 (25.6)</td>
<td>2949 (17.7)</td>
<td>1717 (16.8)</td>
<td>1067 (19.4)</td>
<td>165 (19.5)</td>
</tr>
<tr>
<td>None</td>
<td>630 737 (15.2)</td>
<td>2680 (16.1)</td>
<td>603 (5.9)</td>
<td>1959 (35.6)</td>
<td>118 (13.9)</td>
</tr>
</tbody>
</table>

Abbreviations: ICU, intensive care unit; IQR, interquartile range; NTDB, National Trauma Data Bank.

### Elderly Patients

A total of 848 elderly patients who experienced domestic violence were identified during the study period. Of these elderly patients, 364 (42.9%) were male, the mean (SD) age was 66.6 (9.4) years, and the median Injury Severity Score was 9 (interquartile range, 4-16). There was a significant difference in sex distribution between elderly patients who experienced domestic violence and those who experienced traumatic events other than domestic violence, with female patients more likely than male patients to have experienced domestic violence (57% vs 50%; \( P = .001 \)). The most common perpetrators of domestic violence among elderly patients were other relatives (42.7%), followed by a significant male relative (44.6) and a significant female relative (31%). The most common perpetrator against elderly female patients was a significant male relative (44.6%), whereas the most common perpetrators against elderly male patients were other relatives (42.7%) (eTable 2 in the Supplement).
Discussion

Domestic violence continues to be a significant societal and health care burden in the United States. Using the NTDB, we aimed to identify the burden of this social problem on trauma centers. The overall prevalence of domestic violence was 5.7 cases per 1000 trauma center discharges, with an increasing trend over the years. This trend was more marked among children than among adults and the elderly. Also, over the study period, the rate of domestic violence was increasing for both male and female patients.

Child Abuse

The United States has one of the highest child abuse rates among industrialized countries. This social evil spans all socioeconomic, ethnic, religious, and cultural lines and across all levels of education. To counter this problem, all the states have made it mandatory for a physician to report any incident of child abuse to the appropriate authorities. However, identifying abuse and neglect and linking children to appropriate services have always been problematic.

According to the National Child Abuse and Neglect Data System, approximately 686,000 children were exposed to child abuse and neglect in 2012, and 1,593 children died. An analysis of self-reported abuse and neglect from 15,197 participants in the National Longitudinal Study of Adolescent Health found that 28% experienced physical assault, 12% physical neglect, 5% contact sexual abuse, and 42% supervision neglect. The annual rate of child abuse as reported by the US Department of Health is 10 cases per 1000 inpatients, with a decreasing trend in overall incidence of child abuse over the years. The rate of child abuse in our study was 17 cases per 1000 trauma center discharges, higher than the national average. Because we included only trauma patients as our denominator, in contrast to all children, this can explain the difference in the 2 rates. However, in contrast to the national trends, we observed an increasing trend in child abuse over the past several years. It has been widely published in the literature that the reported cases of child abuse is a gross underestimation of the total number of cases; this increasing trend could represent better reporting and identification of child abuse rather than an actual increase in the number of cases of child abuse.

Sex remains a significant factor for the susceptibility of abuse among children, especially in developing countries. However, the literature from the United States reports that both male and female children are equally susceptible to child abuse. Although there was no difference in the distribution between male and female children who experienced abuse, the male to female ratio was higher among children who experienced domestic violence than among children who experienced traumatic events other than domestic violence. This divergence from national trends can be due to the differences in the nature of abuse experienced by male and female children. Male children are more often exposed to physical abuse, a form of abuse among patients more likely to present to trauma centers as opposed to neglect or sexual abuse. Our population consisted of only trauma patients, which could explain the increased prevalence of domestic violence among male children. Another important consideration while interpreting our results is the potential difference between male and female children in the threshold of suspicion.

An alarming finding in our study was the significantly higher mortality rate among children (8.6%) than among adults and the elderly. According to the literature, the overall mortality rate in cases of child abuse is very low, around 1600 deaths per year. Because the patient population in our study represents only cases of physical abuse and cases that presented to a trauma center, this high mortality rate might not be a true rate for all the cases of child abuse. Furthermore, the median Injury Severity Score for children in our study was 14, which is higher than that for children who experienced nonphysical forms of abuse, thus contributing to the increased mortality.

Children who were abused had longer hospital and intensive care unit lengths of stay and prolonged mechanical ventilation compared with the adults and the elderly who were abused. This delay in trauma center discharge could be secondary to injury severity, but the involvement of multidisciplinary teams in the treatment of children who were abused can also contribute to longer hospital lengths of stay. Early intervention and better outreach to troubled families can help reduce these high health care costs.

Adult Abuse

Adult abuse or IPV describes physical, sexual, and psychological harm incurred from a current or former partner or spouse. Around the world, 1 in every 3 women has faced some kind of domestic abuse. In the United States, 4 to 6 million relationships have a partner that encounters IPV at some point in their adult life. Women are more frequently exposed to domestic violence. According to the literature, up to 85% of those exposed to IPV are women. Around 1.3 to 5.3 million women face some kind of IPV annually in the United States. The lifetime prevalence of IPV for women is reported to be 23%. The results of our study also show a higher prevalence of IPV among adult female patients than among adult male patients. Although male patients were less likely to be exposed to IPV in our study, like female patients, they do show an increasing trend over the study years.

Studies performed in the emergency department and trauma setting show a high prevalence of domestic violence.
It has been reported that 22% to 54% of the patients presenting to the domestic violence department are those exposed to domestic violence.16-20 In contrast to these studies, we found a very low rate of abuse among adult female patients (5 cases per 1000 trauma center discharges). This disparity is alarming. The reason for this could be a nonuniform screening criteria or a nonstandardized definition of IPV. Another important factor could be the difference in study methods. Studies reporting the prevalence of IPV in the health care setting usually adopt a prospective active questionnaire method, which effectively detects more cases of IPV, but the generalization of these results is limited to centers practicing similar methods for screening IPV. Because we have reported only diagnosed and coded cases of IPV, the findings of our study align more closely to routinely diagnosed rates of IPV as a result of usual screening protocols in a trauma center. This disparity also brings into question our current system’s ability to effectively detect cases of IPV.

The number of reported cases of domestic violence is relatively small compared with other forms of injury and trauma, which might be the reason for the limited resource allocation given to this problem. It needs to be understood that domestic violence is a self-sustaining and self-perpetuating problem. Studies have identified that those exposed to one form of violence turn out to be perpetrators of other forms of violence, if there is no intervention.21,22 Also, although domestic violence is commonly thought of as an acute problem with immediate treatment,23 there is still a need for further efforts to significantly affect this lethal and costly societal and health care problem.

Limitations
Our study is a retrospective analysis of a national database, and we are reporting only the diagnosed and recorded cases of domestic violence. Also, the variability in definitions and in reporting systems for domestic violence has made it difficult to provide uniform data, which can be a potential limitation to our study. Over the study period, changes in the reporting system and in management strategies could also have contributed to the increasing incidence of domestic violence. However, owing to the limitations of the data, this issue cannot be addressed.

Conclusions
Domestic violence is a social and moral dilemma with significant health care liabilities. The increasing prevalence of domestic violence in trauma centers needs to be carefully scrutinized. It appears from the results of our study that there is a lack of proper screening and subsequent reporting of domestic violence, especially among adults and the elderly. Initiation of active screening and preventive measures, robust educational campaigns, and uniform screening strategies in trauma centers might help counter this silent epidemic.


