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Prevention of firearm injuries in children

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Disclosures

All topics are updated as new evidence becomes available and our [peer review process](#) is complete.

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INTRODUCTION — Firearm injury, a major cause of morbidity and mortality in the United States [1-3], is an important medical and public health problem [4,5]. Children may be injured or killed in shootings, may lose parents, siblings, or other relatives in shootings, or may be adversely affected by witnessing shootings [6]. (See "[Childhood exposure to intimate partner violence](#)".)

This topic review will describe the epidemiology of pediatric firearm injury, review strategies for prevention of firearm injuries in children, and define the clinician's role in firearm safety. The primary focus will be on unintentional handgun injuries. Intentional violence is discussed in detail separately. Societal issues associated with firearm injuries, such as Second Amendment rights and individual freedoms and responsibilities exceed the scope of this topic review. Some aspects of these issues are discussed in detail [7]. (See "[Peer violence and violence prevention](#)" and "[Suicidal behavior in children and adolescents: Epidemiology and risk factors](#)".)

DEFINITIONS — The word "firearm" is a general term that is used to describe all types of guns, including rifles, shotguns, and handguns [5]. Traditional firearms propel a projectile by burning gunpowder. Nonpowder firearms such as pellet guns, air rifles, and BB guns use compressed air or carbon dioxide to propel the projectile [8]. Although technically a firearm, a taser fires electrical probes to deliver a shock.

- Rifles and shotguns are long guns that typically are fired from the shoulder; rifles fire solid bullets, whereas shotguns fire shells that contain pellets.
- Handguns (eg, pistols and revolvers) are fired from the hand. Revolvers fire cartridges that are placed in one of several chambers within a revolving cylinder. Pistols fire ammunition from a magazine or clip; they can be manually operated or semi-automatic.
- Semi-automatic weapons reload automatically, but have a trigger that must be squeezed after each firing; ammunition usually is carried in magazines or clips of various capacities.
- Fully automatic weapons reload and fire continuously when the trigger is held and not released.
- Assault weapons are automatic or semi-automatic weapons that are capable of rapid fire from a large magazine.

SCOPE OF THE PROBLEM

Epidemiology — Compared with other industrialized countries, the United States has the highest rate of firearm-related deaths among children younger than 15 years of age [9,10]. Firearm-related deaths among children have declined since 1993; however, in 2007, 2251 children younger than 19 years of age were killed by firearms, and in 2009, 9981 were injured ([table 1](#)) [11]. Most pediatric firearm-related deaths occur before [12,13] or within 24 hours

of hospital arrival [14].

Although surveillance data for firearm injury are inadequate, and the intent potentially misclassified [15], most firearm-related deaths are attributed to homicides affecting minority male teens [16,17]. Among individuals aged 1 to 18 years, homicide is the second leading cause of death, and firearms account for 68 percent of those homicides (figure 1) [16]. In unintentional fatalities, the overwhelming number of shooters (81 percent) was under the age of 25 [18].

Nearly all unintentional firearm fatalities in children occur in or around the home; 50 percent occur in the home of the victim, while nearly 40 percent occur in the home of a friend or relative [19-21]. Shootings in rural areas are more likely to occur outdoors and with a shotgun or rifle; shootings in urban areas are more likely to occur indoors and with a handgun [22]. Unintentional shootings typically occur when children are unsupervised [20,23,24] and out of school (eg, in the late afternoon, on weekends, and during the summer months and holiday seasons) [19]. Rural counties have higher rates of pediatric suicide associated with a firearm, while urban counties have significantly higher rates of pediatric homicides [25].

According to the 2011 Youth Risk Behavior Survey, a nationwide survey of high school students, 5.1 percent of 9th- through 12th-grade students reported carrying a gun at least one day in the 30 days before the survey [26]. Gun carrying was more common among boys than girls (8.6 versus 1.4percent). Gun carrying is associated with the use of violence and illicit drugs at school. Adolescents who carry guns to school report that they do so because they are afraid or because of peer pressure [27-29].

Socioeconomic impact — The impact of firearm-related deaths and injuries to children extends beyond the pain and suffering of the victims and their families. Not only do firearm injuries put a burden on the health care and criminal justice systems, they also lead to a reduction in the work force due to deaths and disabilities. The total cost of firearm-related assaults, homicides, suicides, and self-inflicted firearm injuries in the United States in 2000 was estimated to exceed 33.5 billion dollars; cost estimates included direct medical costs (eg, ambulance, emergency department, medical examiner, etc) and lost productivity [30].

The hidden costs of firearm injuries are reflected in the fear and worry that permeate inner-city neighborhoods. A meta-analysis of 114 studies concluded that community violence, which included gun violence, was a predictor for the development of posttraumatic stress disorder (PTSD) in children and adolescents [31]. Because firearms can kill from a distance, the sounds of gunshots reduce the desirability of neighborhoods, thereby reducing urban property values, which results in lost revenue [32].

PREVENTION OF FIREARM INJURIES — The identification of strategies to prevent firearm injuries can be illustrated by using the Haddon Injury Control Model (table 2). The Haddon Injury Control Model is discussed in detail separately. (See "[Overview of pediatric injury prevention: Epidemiology; history; application](#)", section on '[Principles of injury prevention and control](#)'.)

The most effective approach to injury prevention typically involves the combination of several strategies. Although counseling and education alone may not be particularly effective, they can be augmented by legislation and regulation (eg, for safer or childproof guns) [33]. (See "[Overview of pediatric injury prevention: Epidemiology; history; application](#)", section on '[Principles of injury prevention and control](#)'.)

Pre-event strategies — Because of the high potential for mortality in firearm injuries, pre-event strategies (ie, those that prevent the discharge of bullets) are the preferred methods of prevention. Pre-event strategies focus on changes in the following areas:

- The behavior of the child or family
- The environment of the firearm
- The manufacture of firearms with safety features
- Educational, regulatory, and legislative changes

Family counseling — It is estimated that 2 to 13 percent of children younger than 18 years of age live in households that contain loaded firearms [34-36], and only 6 percent of families with children surveyed kept their guns unloaded, locked, locked up, or separate from ammunition [37]. Families that keep firearms in the home often cite the need for personal protection. However, keeping guns in the home is associated with an increased risk of homicide by a family member or intimate acquaintance (odds ratio 2.7; 95% CI, 1.6-4.4) [38,39]. Data from the 2006 National Violent Death Reporting System indicate that 73 percent of all unintentional firearm fatalities took place in a house or apartment, making these the most common places of injury [21].

A case-control study was performed to measure the association of firearm storage practices and the risk of unintentional and self-inflicted firearm injuries [40]. Cases were events in which a child or adolescent (<20 years) gained access to a firearm and shot him- or herself intentionally or unintentionally, or shot someone else unintentionally. Guns that were involved in such events (85 suicide attempts, 25 unintentional injuries) were less likely than were control guns:

- To have been stored unloaded (odds ratio [OR] 0.30)
- To have been locked away (OR 0.27)
- To have been separated from ammunition (OR 0.45)
- To have had the ammunition locked away (OR 0.39)

These four strategies, each associated with decreased risk of firearm injury, can be used to prevent suicide and unintentional injury in children and adolescents in gun-owning households.

Parents may not realize the risk that a gun in the home poses to them or their children, may underestimate their child's ability to gain access to a gun, and may overestimate their child's ability to distinguish between a toy and real gun, to make good judgments about handling a gun, and to consistently follow rules about gun safety [41-46]. In one telephone survey of households with children between 5 and 15 years of age, nearly 90 percent (regardless of gun ownership or age of child), responded that they believed that if their child found a gun, he or she would not touch it [47]. Approximately one-half of respondents said their child was "too smart" or "knew better" than to handle a gun.

Firearms may be easily accessible even if they are not kept in the home. In a national, random digit-dial survey, 7 percent of respondents reported they did not have a firearm in or around their home, but would be able to retrieve and fire one within 10 minutes if desired [48]. Most guns that are involved in self-inflicted or unintentional injuries come from the home of the victim or the home of a friend or relative of the victim [49].

Access to firearms increases the risk of violence against peers. The majority of firearms used in school-based shootings in the United States were obtained from the homes of the perpetrators or their friends or relatives [50]. Most of these weapons (89 percent) were handguns, and one-half were automatic or semiautomatic [51]. Access to firearms also increases the risk of completed suicide, particularly among adolescents. Surveillance data from the CDC recorded a high rate of fatalities from firearm related traumatic brain injuries among boys age 10 to 14 [52]. This finding suggests that other targeted prevention programs such as those identified by [Blueprints for Violence Prevention](#) may help reduce risk factors. (See "[Peer violence and violence prevention](#)", section on '[Access to firearms and weapon carrying](#)' and "[Suicidal behavior in children and adolescents: Epidemiology and risk factors](#)", section on '[Firearms](#)'.)

Given that guns in the home are associated with increased risks of homicide, completed suicide, and unintentional injury, the removal of guns from the home and the secured storage of guns in the home are logical strategies for reducing injury-related mortality. Many pediatric health care providers agree that physicians have a responsibility to counsel their patients and patients' families about firearm safety [53]. More than 80 percent of pediatricians believe that such counseling helps to prevent firearm injuries [54]. However, fewer than 40 percent "sometimes" counsel families about the presence of guns in the home [54,55]. Reasons for the lack of counseling may include underestimation of gun ownership by their patients [56], time constraints, and lack of perceived effectiveness of counseling [57,58].

Safety counseling by physicians has been shown to be effective in increasing seat belt and car seat use [59]. Data supporting the efficacy of firearm safety counseling in preventing firearm injury are inconsistent. However, a meta-analysis of parenting interventions in the prevention of unintentional injuries suggests that safety counseling may improve the safe storage of firearms in the home [60].

- In one study, 156 gun-owning family practice patients were assigned (by day) to receive brief verbal counseling, verbal counseling and a gun-safety brochure, or no counseling [61]. At the post-intervention interview, 58 to 64 percent of patients in the intervention groups made a safe change in gun storage practice (versus 33 percent in the control group).
- In another study, primary care physicians, nurse practitioners, and physicians' assistants were randomly assigned to provide a single, brief firearm-safety counseling session at a regularly scheduled health care visit, or to a control group that provided no such counseling. The counseling session included information about the risks of gun ownership and, for gun-owning families, recommendations regarding safe gun storage and discount coupons for gun storage devices [62]. The counseling session did not lead to changes in firearm ownership three months after the visit; however, the proportion of families that purchased trigger locks was greater among the intervention group (8 versus 2.5 percent, not statistically significant).

Providing a gun lock, rather than a discount coupon, to gun-owning families may increase the usage of gun locks. In another study, 82 participants received tailored counseling and a gun lock with instructions on how to use it [63]. At follow-up, compared to baseline, there was an increase in the storage of guns in a locked compartment (77 versus 48 percent) and the use of gun locks (72 versus 0 percent), and a decrease in the storage of guns loaded and unlocked (7 versus 18 percent).

Current evidence is insufficient to determine whether clinical advice influences patients to remove or safely store guns [64,65]. Nonetheless, as long as guns are present in the environments of children, health care providers are urged to inform parents of the risks of gun-related injuries and how such injuries can be prevented [4]. Anticipatory guidance regarding guns is recommended by the American Academy of Pediatrics (AAP), the American Academy of Family Physicians (AAFP), the American College of Physicians, and the Society for Adolescent Medicine [4,5,66,67]. Physicians who counsel families about firearm safety may want to use the firearm safety tips provided by the [National Safe Kids Campaign](#) (table 3). (See '[Clinician's role](#)' below.)

Gun safety programs — Gun safety programs focus on gun avoidance or the safe handling and storage of firearms. These programs usually are targeted to specific age groups. The [Eddie Eagle Gun Safety Program](#), developed by the National Rifle Association (NRA), is probably the best-known gun safety program. It tells children that if they see a gun they should, "Stop! Don't touch. Leave the area. Tell an adult." The NRA reports a 56 percent reduction in unintentional firearm injuries among children since 1988, the year the program was "hatched" [68]. However, neither Eddie Eagle nor other gun safety programs have been systematically studied for efficacy [69].

Firearm mortality among children has declined since the early 1990s. However, the reasons for the decline are not clear. Possible explanations include prevention efforts, changes in factors that affect the frequency of violence, and changes in factors that affect whether guns are present when violence occurs [70]. The efficacy of gun safety programs that are directed at children should be evaluated before such programs are widely implemented [71].

Gun safety programs alone do not appear to reduce the likelihood that children will handle firearms [69]. In one study, 70 children between the ages of four and seven years were randomly assigned to participate in a week-long firearm safety program or to the control group [42]. After the program, pairs of children were observed in a structured setting in which they had access to a semiautomatic pistol. A total of 53 percent of the pairs played with the gun. Gun play behavior did not differ between the intervention and control groups.

In another study, a convenience sample of 29 8- to 12-year-old boys and one or two of their siblings or playmates were placed in a room in which two water pistols and a handgun were concealed in separate drawers [41]. The pair or trio of boys was observed through a one-way mirror. Twenty-one of the groups (72 percent) discovered the

handgun (approximately one-half of these boys thought that it was a toy or were unsure whether it was real); 16 groups handled it; and one or more of the boys in 10 of the groups pulled the trigger with enough force to discharge the firearm. More than 90 percent of the boys who handled the gun reported that they had received some sort of gun safety instruction in the past.

Programs that describe the safe handling and storage of firearms are beyond the scope of this review but are provided by the [National Shooting Sports Foundation](#).

Gun safety features — As described above, counseling and gun safety programs are not particularly effective strategies for the prevention of firearm injuries. Strategies that prevent unintentional firing may be more effective, because children — even those who have received gun avoidance training— are likely to handle guns and pull the trigger [41,42]. Data from retrospective studies indicate that approximately one-third of unintentional shootings could be prevented if guns were required to have safety features to prevent unintentional firing [72,73].

Although the passage of gun regulations has been relatively unsuccessful, gun safety measures appear to have public support. In 1999, The National Opinion Research Center conducted a survey of a representative sample of 1200 Americans; 94 percent of the respondents favored federal handgun safety standards, and 88 percent agreed that all new handguns should be childproof [74]. (See 'Legislation' below.)

Gun modifications to protect children were initiated more than 100 years ago, when Smith and Wesson equipped a .38-caliber handgun with a safety device to prevent firing by children. Currently available safety devices to prevent the unintentional firing of handguns include [75,76]:

- Loaded chamber indicator
- Magazine disconnect device
- Grip safety device
- Firing pin block

The loaded chamber indicator is a device that indicates the presence of a bullet in the chamber of a pistol. In one study, 13 percent of domestic pistols and 22 percent of imported pistols were equipped with a loaded chamber indicator [75].

The magazine disconnect device prevents firing of a forgotten pistol cartridge. Even after the magazine has been removed from the pistol, a bullet may remain in the chamber. The magazine disconnect device physically prevents the gun from firing if the magazine or clip has been removed from the handle of a pistol. In one study, 21 percent of domestic and 22 percent of imported pistols were equipped with a magazine disconnect device [75].

A grip safety is a lever located on the grip of a handgun that must be compressed to permit firing. It was designed to make the gun difficult for a child to fire. In one study, 20 percent of domestic pistols, 6 percent of imported pistols, and no revolvers were equipped with a grip safety device [75].

The firing pin block, or drop safety, prevents discharge if the gun is unintentionally dropped on its hammer. In one study, 70 percent of domestic pistols, 87 percent of imported pistols, and 99 percent of revolvers were equipped with a drop safety device [75].

The manufacture of personalized handguns (ie, those that can be fired only by their owners) is a strategy that holds promise for the future [77,78]. Examples include a personal identification number that is programmed into the firearm at the time of sale, or the requirement of fingerprint recognition to fire the gun or remove it from the holster. The technology for the personalization of handguns has been developed for other applications and needs modification for use in firearms.

In contrast to the potential development of safer handguns, efforts to develop "safer bullets" have been unsuccessful. Low-velocity rubber and plastic bullets have been used by the Israeli police for crowd control, but the use of these bullets has been associated with multiple fatalities. The resistance of the body surface at the site of impact determined whether a blunt or penetrating injury would result [79,80]. Most of the fatalities resulted from

ocular injuries penetrating into the brain. Injury severity also was increased by firing at close range.

Legislation — Legislative efforts to regulate handguns have been largely unsuccessful. Federal legislative efforts, such as the Childproof Handgun Act and the Firearm Safety and Violence Prevention Act, have all died in committee. Multiple attempts to bring handguns and ammunition under the jurisdiction of the Consumer Product Safety Commission (CPSC) have met with failure.

Information about federal firearm regulations and current congressional firearm legislation efforts is available from the [Coalition to Stop Gun Violence](#). Information about state firearm laws and ordinances is available through the Bureau of Alcohol, Tobacco, Firearms and Explosives.

In 1968, Congress passed the Gun Control Act, which, among other things, barred the importation of handguns that were not "generally recognized as particularly suitable for or readily adaptable to sporting purposes" [81]. The Bureau of Alcohol, Tobacco, and Firearms (ATF) developed a set of design and performance specifications, known as the factoring criteria, to implement the "sporting purposes" test [82]. Domestic manufacturers are exempt from the factoring criteria.

Federal legislation that would extend the factoring criteria to all handguns sold in the United States, no matter where they were manufactured, has been proposed [83-86], but such legislation is unlikely to significantly increase the proportion of handguns with safety features [75]. Two-thirds of domestically manufactured handguns already meet the factoring criteria, although fewer than 25 percent contain loaded chamber indicators, magazine disconnect devices, or grip safeties [75].

Legislation requiring safety features or limiting access to handguns may be a more effective means of preventing handgun injury. A 1976 law that banned the purchase, sale, transfer, or possession of handguns by civilians in Washington, DC was associated with a reduction in handgun-related homicide and suicide [87]. Handgun-related homicides declined by 3.3 per month, or 25 percent, and suicides by 0.6 per month, or 23 percent, compared to non-gun-related cases and rates in surrounding suburbs. In another study, crime rates in two similar cities were compared, one in the United States (Seattle) and the other in Canada (Vancouver), where availability of handguns is limited through more restrictive regulation [88]. During the study period, the risk of homicide by handgun was 4.8 times greater in Seattle than Vancouver; rates of homicide by other means were similar in the two cities. A systematic review of firearms laws and prevention of violence found insufficient evidence to determine the effectiveness of laws restricting firearm acquisition or banning access to specified firearms or ammunition [89].

Some states, such as Massachusetts and California, have passed regulations that require a safety feature to prevent firing by children for all commercially sold handguns. Other states have laws that make gun owners criminally liable if someone is injured because a child gains unsupervised access to a gun. In an ecological study of firearm mortality from 1979 to 1994, among states with such laws, unintentional shooting deaths among children younger than 15 years were reduced by 23 percent (95% CI 6-37 percent) during the years covered by the laws [90]. A systematic review of firearms laws and prevention of violence found insufficient evidence to determine the effectiveness of child access prevention laws [89]. However, comparison of suicide rates among adolescents (14 to 20 years) from states with and without various types of firearm legislation found a modest decrease (8.3 percent) in suicide rates among 14- to 17-year old children in the states with child access prevention laws (5.97 per 100,000 population versus the projected 6.51 per 100,000 population) [91].

Several local municipalities and individuals have brought suit against gun manufacturers for safety design failures. Because many of these cases are settled before the case is brought to trial, it is not clear whether this approach will influence gun manufacturers to design guns with safety features to reduce the incidence of gun-related injuries to children. The continued use of this strategy may be limited by legislation proposed in Congress to shield gun manufacturers from civil claims made by victims of gun violence [92].

Event strategies — Event strategies are designed to modulate the transfer of energy from the agent (ie, bullet) to the child. One such strategy is to minimize the discharging of firearms in the environments of children (eg, limit firearm practice to practice ranges). Few strategies are available once the bullet is discharged from the gun. The

use of bulletproof vests has been effective for police officers and military personnel, but is impractical for children.

The logical, but unproven, premise that the discharge of fewer bullets would result in decreased morbidity and mortality was the basis for legislation to limit the availability of assault weapons (automatic or semiautomatic firearms). The Violent Crime Control and Law Enforcement Act of 1994 prohibited the manufacture, transfer, and possession of semiautomatic assault weapons and ammunition magazines that hold more than 10 rounds of ammunition (except for law enforcement officials). The law expired in September 2004.

Post-event strategies — Post-event strategies are designed to prevent morbidity and mortality in the injured child (the classic medical response model). Ongoing efforts to improve the children's emergency medical system and rehabilitation are always recommended. (See "[Prehospital pediatrics and emergency medical services \(EMS\)](#)".)

Surveillance for and analysis of data from firearm injuries can help to identify risk factors, causes, and possible prevention strategies for the future [93,94]. Full, accurate documentation of injury events, including the "who, what, when, where, why, and how" of the injury occurrence and whether protective equipment (eg, a safety device) was used, is an essential step in injury prevention [95]. This information helps to define the extent of the problem and provides the basis for preventive counseling and prevention strategies.

CLINICIAN'S ROLE — Firearm-related injuries are an important cause of death among children and adolescents. Pediatric health professionals can provide leadership for improved gun safety through education of patients and families, advocacy for legislation that protects children from firearm injuries, or becoming informed spokespersons for firearm safety.

The American Academy of Pediatrics (AAP) [4], the American Academy of Family Physicians (AAFP) [66], the Society for Adolescent Medicine [67], and the American College of Physicians (ACP) [5] have issued policy or position statements regarding the prevention of firearm injuries.

The following recommendations are included:

- The absence of guns from the home is the most effective means of prevention of firearm injuries in children.
- Health care providers are encouraged to inform their patients and patients' parents about the dangers of firearms. Parents who possess guns, particularly handguns, should be encouraged to remove them from the home or to store them safely (unloaded and locked, with ammunition stored securely in a separate location).
- Guns should be regulated like other consumer products (eg, by the Consumer Product Safety Commission [CPSC]).
- The above groups support legislation restricting the possession and sale of firearms (particularly assault weapons), requiring operative trigger locks, and requiring the safe storage of firearms (ie, locked away and unloaded).
- Firearm injury prevention and intervention strategies and regulations should be evaluated for effectiveness (eg, safe storage techniques and educational programs) to better allocate resources and prevent the perpetuation of ineffective strategies.
- A national firearm injury surveillance data system should be developed and maintained [66].

RESOURCES — The following resources may be helpful to pediatric health care providers in counseling their patients and patients' families about firearm safety:

- [American Academy of Family Physicians](#)
- [American Academy of Pediatrics](#)
- [Brady Center to Prevent Gun Violence](#)

- [The Coalition to Stop Gun Violence](#)
- [Johns Hopkins Center for Gun Policy Research](#)
- [National Safe Kids Campaign](#)

SUMMARY

- Firearm injuries and deaths among children are common in the United States. Most unintentional firearm deaths occur in or around the home. (See '[Scope of the problem](#)' above.)
- Strategies to prevent firearm injuries in children can be categorized according to their time of implementation: pre-event, event, or post-event ([table 2](#)). (See '[Prevention of firearm injuries](#)' above.)
- Policy and position statements from the American Academy of Pediatrics (AAP), the American Academy of Family Physicians (AAFP), the Society for Adolescent Medicine, and the American College of Physicians (ACP) encourage healthcare providers to inform their patients and patients' parents about the dangers of firearms.

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REFERENCES

1. Christoffel KK, Christoffel T. Handguns as a pediatric problem. *Pediatr Emerg Care* 1986; 2:75.
2. Coben JH, Steiner CA. Hospitalization for firearm-related injuries in the United States, 1997. *Am J Prev Med* 2003; 24:1.
3. Zavoski RW, Lapidus GD, Lerer TJ, Banco LI. A population-based study of severe firearm injury among children and youth. *Pediatrics* 1995; 96:278.
4. Dowd MD, Sege RD, Council on Injury, Violence, and Poison Prevention Executive Committee, American Academy of Pediatrics. Firearm-related injuries affecting the pediatric population. *Pediatrics* 2012; 130:e1416.
5. Firearm injury prevention. American College of Physicians. *Ann Intern Med* 1998; 128:236.
6. Garbarino J, Bradshaw CP, Vorrasi JA. Mitigating the effects of gun violence on children and youth. *Future Child* 2002; 12:72.
7. Rawson B. Aiming for prevention: medical and public health approaches to small arms, gun violence, and injury. *Croat Med J* 2002; 43:379.
8. O'Neill PJ, Lumpkin MF, Clapp B, et al. Significant pediatric morbidity and mortality from intracranial ballistic injuries caused by nonpowder gunshot wounds. A case series. *Pediatr Neurosurg* 2009; 45:205.
9. Fingerhut LA, Warner M. Injury Chartbook. In: *Health, United States, 1996-97*, National Center for Health Statistics, Hyattsville, MD 1997.
10. Richardson EG, Hemenway D. Homicide, suicide, and unintentional firearm fatality: comparing the United States with other high-income countries, 2003. *J Trauma* 2011; 70:238.
11. Web-based Injury Statistics Query and Reporting System. Centers for Disease Control and Prevention, National Center for Injury Prevention and Control. www.cdc.gov/ncipc/wisqars (Accessed on May 14, 2009).
12. Cooper A, Barlow B, Davidson L, et al. Epidemiology of pediatric trauma: importance of population-based statistics. *J Pediatr Surg* 1992; 27:149.
13. Lee RK, Waxweiler RJ, Dobbins JG, Paschetag T. Incidence rates of firearm injuries in Galveston, Texas, 1979-1981. *Am J Epidemiol* 1991; 134:511.
14. Nance ML, Branas CC, Stafford PW, et al. Nonintracranial fatal firearm injuries in children: implications for treatment. *J Trauma* 2003; 55:631.

15. Schaechter J, Duran I, De Marchena J, et al. Are "accidental" gun deaths as rare as they seem? A comparison of medical examiner manner of death coding with an intent-based classification approach. *Pediatrics* 2003; 111:741.
16. Centers for Disease Control and Prevention. Injury prevention and control: Data and statistics (WISQARS). <http://www.cdc.gov.ezproxylocal.library.nova.edu/injury/wisqars/index.html> (Accessed on August 09, 2011).
17. Senger C, Keijzer R, Smith G, Muensterer OJ. Pediatric firearm injuries: a 10-year single-center experience of 194 patients. *J Pediatr Surg* 2011; 46:927.
18. Hemenway D, Barber C, Miller M. Unintentional firearm deaths: a comparison of other-inflicted and self-inflicted shootings. *Accid Anal Prev* 2010; 42:1184.
19. Li G, Baker SP, DiScala C, et al. Factors associated with the intent of firearm-related injuries in pediatric trauma patients. *Arch Pediatr Adolesc Med* 1996; 150:1160.
20. Wintemute GJ, Teret SP, Kraus JF, et al. When children shoot children. 88 unintended deaths in California. *JAMA* 1987; 257:3107.
21. Karch DL, Dahlberg LL, Patel N, et al. Surveillance for violent deaths--national violent death reporting system, 16 States, 2006. *MMWR Surveill Summ* 2009; 58:1.
22. National Safe Kids Campaign (NSKC). Unintentional Firearm Injury Fact Sheet. NSKC, Washington, DC, 2004.
23. Smith DR, Cohen J, Lautman B. Child's play: A study of 266 unintentional handgun shootings of children. Center to Prevent Handgun Violence, Washington DC, 1992.
24. Center to Prevent Handgun Violence. The killing seasons: A study of when unintentional handgun shootings among children occur. Center to Prevent Handgun Violence, Washington, DC 1989.
25. Nance ML, Carr BG, Kallan MJ, et al. Variation in pediatric and adolescent firearm mortality rates in rural and urban US counties. *Pediatrics* 2010; 125:1112.
26. Eaton DK, Kann L, Kinchen S, et al. Youth risk behavior surveillance - United States, 2011. *MMWR Surveill Summ* 2012; 61:1.
27. McNabb SJ, Farley TA, Powell KE, et al. Correlates of gun-carrying among adolescents in south Louisiana. *Am J Prev Med* 1996; 12:96.
28. *In the Line of Fire: Youth, Guns, and Violence in Urban America*, Aldine Transaction, New York 1995.
29. Blumstein A, Cork D. Linking gun availability to youth gun violence. *Law Contemp Prob* 1996; 59:5.
30. Corso PS, Mercy JA, Simon TR, et al. Medical costs and productivity losses due to interpersonal and self-directed violence in the United States. *Am J Prev Med* 2007; 32:474.
31. Fowler PJ, Tompsett CJ, Braciszewski JM, et al. Community violence: a meta-analysis on the effect of exposure and mental health outcomes of children and adolescents. *Dev Psychopathol* 2009; 21:227.
32. Cullen JB, Levitt SD. Crime, urban flight, and the consequences for cities. *Rev Econom Stat* 1999; 81:159.
33. Christoffel KK. Toward reducing pediatric injuries from firearms: charting a legislative and regulatory course. *Pediatrics* 1991; 88:294.
34. Powell KE, Jacklin BC, Nelson DE, Bland S. State estimates of household exposure to firearms, loaded firearms, and handguns, 1991 through 1995. *Am J Public Health* 1998; 88:969.
35. Schuster MA, Franke TM, Bastian AM, et al. Firearm storage patterns in US homes with children. *Am J Public Health* 2000; 90:588.
36. Johnson RM, Miller M, Vriniotis M, et al. Are household firearms stored less safely in homes with adolescents?: Analysis of a national random sample of parents. *Arch Pediatr Adolesc Med* 2006; 160:788.
37. Connor SM. The association between presence of children in the home and firearm-ownership and -storage practices. *Pediatrics* 2005; 115:e38.
38. Kellermann AL, Rivara FP, Rushforth NB, et al. Gun ownership as a risk factor for homicide in the home. *N Engl J Med* 1993; 329:1084.
39. Cummings P, Koepsell TD. Does owning a firearm increase or decrease the risk of death? *JAMA* 1998; 280:471.

40. Grossman DC, Mueller BA, Riedy C, et al. Gun storage practices and risk of youth suicide and unintentional firearm injuries. *JAMA* 2005; 293:707.
41. Jackman GA, Farah MM, Kellermann AL, Simon HK. Seeing is believing: what do boys do when they find a real gun? *Pediatrics* 2001; 107:1247.
42. Hardy MS. Teaching firearm safety to children: failure of a program. *J Dev Behav Pediatr* 2002; 23:71.
43. Laraque D, Spivak H, Bull M. Serious firearm injury prevention does make sense. *Pediatrics* 2001; 107:408.
44. Azrael D, Miller M, Hemenway D. Are household firearms stored safely? It depends on whom you ask. *Pediatrics* 2000; 106:E31.
45. Farah MM, Simon HK, Kellermann AL. Firearms in the home: parental perceptions. *Pediatrics* 1999; 104:1059.
46. Stennies G, Ikeda R, Leadbetter S, et al. Firearm storage practices and children in the home, United States, 1994. *Arch Pediatr Adolesc Med* 1999; 153:586.
47. Connor SM, Wesolowski KL. "They're too smart for that": predicting what children would do in the presence of guns. *Pediatrics* 2003; 111:E109.
48. Ikeda RM, Dahlberg LL, Kresnow MJ, et al. Studying "exposure" to firearms: household ownership v access. *Inj Prev* 2003; 9:53.
49. Grossman DC, Reay DT, Baker SA. Self-inflicted and unintentional firearm injuries among children and adolescents: the source of the firearm. *Arch Pediatr Adolesc Med* 1999; 153:875.
50. Centers for Disease Control and Prevention (CDC). Source of firearms used by students in school-associated violent deaths--United States, 1992-1999. *MMWR Morb Mortal Wkly Rep* 2003; 52:169.
51. Kachur SP, Stennies GM, Powell KE, et al. School-associated violent deaths in the United States, 1992 to 1994. *JAMA* 1996; 275:1729.
52. Coronado VG, Xu L, Basavaraju SV, et al. Surveillance for traumatic brain injury-related deaths--United States, 1997-2007. *MMWR Surveill Summ* 2011; 60:1.
53. Grossman DC, Mang K, Rivara FP. Firearm injury prevention counseling by pediatricians and family physicians. Practices and beliefs. *Arch Pediatr Adolesc Med* 1995; 149:973.
54. American Academy of Pediatrics, Division of Health Policy Research. Periodic Survey of Fellows, Executive Summary. Periodic Survey #47: Firearm Safety Counseling. www.aap.org/research/periodicsurvey/ps47exs.htm (Accessed on April 20, 2006).
55. Barkin S, Duan N, Fink A, et al. The smoking gun: do clinicians follow guidelines on firearm safety counseling? *Arch Pediatr Adolesc Med* 1998; 152:749.
56. Becher EC, Christakis NA. Firearm injury prevention counseling: are We missing the mark? *Pediatrics* 1999; 104:530.
57. Cheng TL, DeWitt TG, Savageau JA, O'Connor KG. Determinants of counseling in primary care pediatric practice: physician attitudes about time, money, and health issues. *Arch Pediatr Adolesc Med* 1999; 153:629.
58. Cohen LR, Runyan CW, Downs SM, Bowling JM. Pediatric injury prevention counseling priorities. *Pediatrics* 1997; 99:704.
59. Bass JL, Christoffel KK, Widome M, et al. Childhood injury prevention counseling in primary care settings: a critical review of the literature. *Pediatrics* 1993; 92:544.
60. Kendrick D, Barlow J, Hampshire A, et al. Parenting interventions and the prevention of unintentional injuries in childhood: systematic review and meta-analysis. *Child Care Health Dev* 2008; 34:682.
61. Albright TL, Burge SK. Improving firearm storage habits: impact of brief office counseling by family physicians. *J Am Board Fam Pract* 2003; 16:40.
62. Grossman DC, Cummings P, Koepsell TD, et al. Firearm safety counseling in primary care pediatrics: a randomized, controlled trial. *Pediatrics* 2000; 106:22.
63. Coyne-Beasley T, Schoenbach VJ, Johnson RM. "Love our kids, lock your guns": a community-based firearm safety counseling and gun lock distribution program. *Arch Pediatr Adolesc Med* 2001; 155:659.

64. Preventing youth violence. In: US Preventive Services Task Force. Guide to Clinical Preventive Services, 2nd ed, Williams & Wilkins, Baltimore 1996. p.687.
65. DiGuseppi C. Counseling to preven household and recreational injuries. In: US Preventive Services Task Force. Guide to Clinical Preventive Services, 2nd ed, DiGuseppi C, Atkins D, Woolf SH (Eds), Williams & Wilkins, Baltimore 1996. p.689.
66. American Academy of Family Physicians. Firearm Safety. <http://www.aafp.org.ezproxylocal.library.nova.edu/online/en/home/policy/policies/ff/firearmsafety.html> (Accessed on October 22, 2012).
67. Duke N, Resnick MD, Borowsky IW. Adolescent firearm violence: position paper of the Society for Adolescent Medicine. *J Adolesc Health* 2005; 37:171.
68. National Rifle Association. Eddie Eagle Web site. www.nrahq.org/safety/eddie/awards.asp (Accessed on April 20, 2006).
69. Promising strategies to reduce gun violence. United States Department of Justice. Office of Justice Programs. Office of Juvenile Justice and Delinquency Programs. http://www.ojjdp.gov/pubs/gun_violence/173950.pdf (Accessed on August 09, 2011).
70. Fingerhut LA, Christoffel KK. Firearm-related death and injury among children and adolescents. *Future Child* 2002; 12:24.
71. American Academy of Pediatrics Committee on Injury and Poison Prevention: Firearm injuries affecting the pediatric population. *Pediatrics* 1992; 89:788.
72. Ismach RB, Reza A, Ary R, et al. Unintended shootings in a large metropolitan area: an incident-based analysis. *Ann Emerg Med* 2003; 41:10.
73. United States General Accounting Office. Accidental shootings: Many deaths and injuries caused by firearms could be prevented. US General Accounting Office; Washington, DC, 1991.
74. Smith TW. 2001 National Gun Policy Survey of the National Opinion Research Center: Research findings. National Opinion Research Center, Chicago, 2000.
75. Milne JS, Hargarten SW, Kellermann AL, Wintemute GJ. Effect of current federal regulations on handgun safety features. *Ann Emerg Med* 2003; 41:1.
76. Vernick JS, Meisel ZF, Teret SP, et al. "I didn't know the gun was loaded": an examination of two safety devices that can reduce the risk of unintentional firearm injuries. *J Public Health Policy* 1999; 20:427.
77. Teret SP, Lewin NL. Policy and technology for safer guns: an update. *Ann Emerg Med* 2003; 41:32.
78. Teret SP, Culross PL. Product-oriented approaches to reducing youth gun violence. *Future Child* 2002; 12:118.
79. Mahajna A, Aboud N, Harbaji I, et al. Blunt and penetrating injuries caused by rubber bullets during the Israeli-Arab conflict in October, 2000: a retrospective study. *Lancet* 2002; 359:1795.
80. Hiss J, Hellman FN, Kahana T. Rubber and plastic ammunition lethal injuries: the Israeli experience. *Med Sci Law* 1997; 37:139.
81. The Gun Control Act of 1968. Pub Law No. 90-618, 82 Stat 1213.
82. Department of the Treasury, Bureau of Alcohol, Tobacco, and Firearms. Factoring Criteria for Weapons. Form 4590 (5330.5)., Bureau of Alcohol, Tobacco, and Firearms, Washington, DC, 1983.
83. American Handgun Standards Act of 1997. S70, 105th Cong, (1997-1998).
84. American Handgun Standards Act of 1997. HR492, 105th Cong, (1997-1998).
85. American Handgun Standards Act of 1999. S193, 106th Cong, (1999-2000).
86. To Prohibit the Possession or Transfer of Junk Guns, Also Known as Saturday Night Specials. HR35, 106th.
87. Loftin C, McDowall D, Wiersema B, Cottey TJ. Effects of restrictive licensing of handguns on homicide and suicide in the District of Columbia. *N Engl J Med* 1991; 325:1615.
88. Sloan JH, Kellermann AL, Reay DT, et al. Handgun regulations, crime, assaults, and homicide. A tale of two cities. *N Engl J Med* 1988; 319:1256.

89. Hahn RA, Bilukha OO, Crosby A, et al. First reports evaluating the effectiveness of strategies for preventing violence: early childhood home visitation. Findings from the Task Force on Community Preventive Services. *MMWR Recomm Rep* 2003; 52:1.
90. Cummings P, Grossman DC, Rivara FP, Koepsell TD. State gun safe storage laws and child mortality due to firearms. *JAMA* 1997; 278:1084.
91. Webster DW, Vernick JS, Zeoli AM, Manganello JA. Association between youth-focused firearm laws and youth suicides. *JAMA* 2004; 292:594.
92. VandeHei J. Gun Firms on Verge of Winning New Shield. *The Washington Post*, May 5, 2003.
93. Rosenberg ML, Hammond WR. Surveillance the key to firearm injury prevention. *Am J Prev Med* 1998; 15:1.
94. Frattaroli S, Teret SP. Why firearm injury surveillance? *Am J Prev Med* 1998; 15:2.
95. Katcher ML, Agran P, Laraque D, et al. The hospital record of the injured child and the need for external cause-of-injury codes. American Academy of Pediatrics. Committee on Injury and Poison Prevention, 1998-1999. *Pediatrics* 1999; 103:524.

Topic 2848 Version 6.0

GRAPHICS**Firearm gunshot nonfatal injuries and deaths, United States, all races, both sexes, ages 0 to 18**

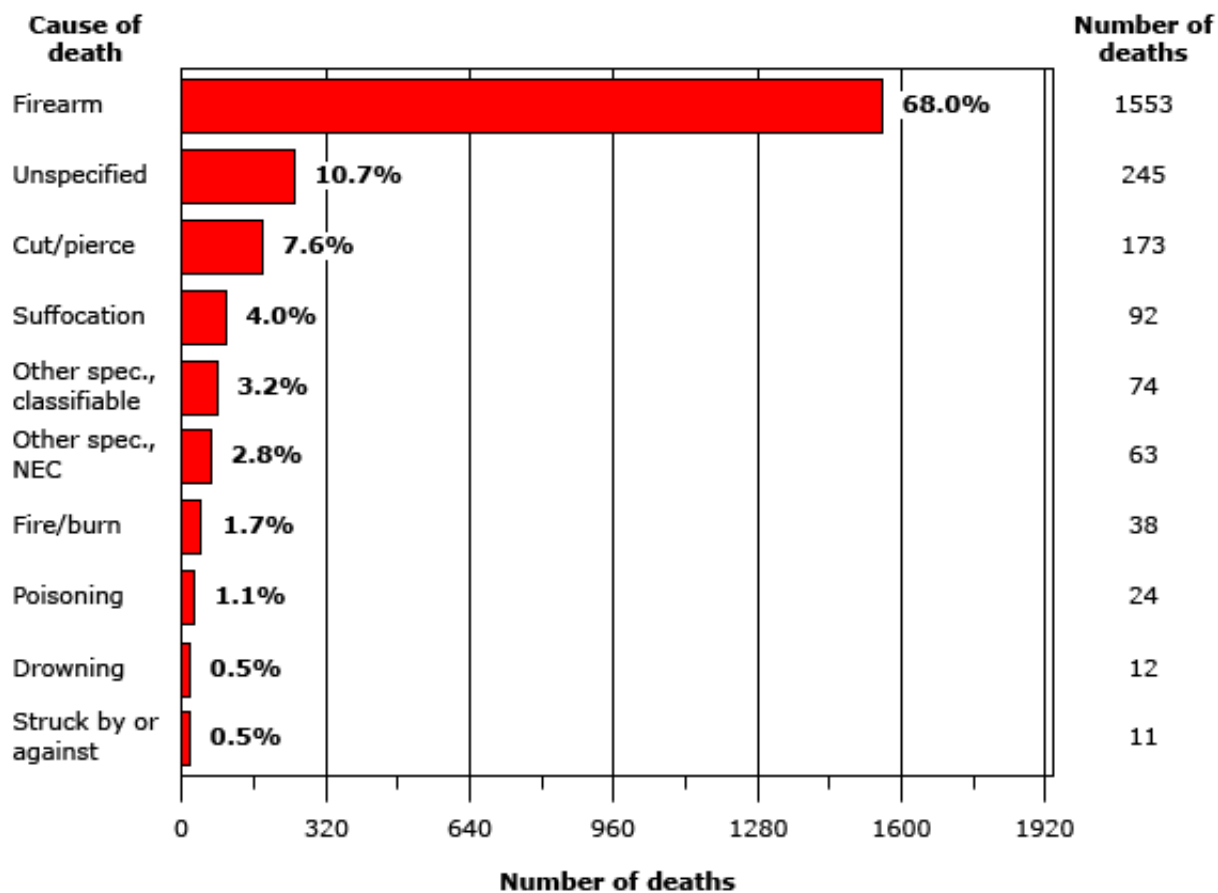
Age (in years)	Number of nonfatal firearm injuries*	Number of firearm deaths[•]
0	38	16
1	89	12
2	0	10
3	111	23
4	0	24
5	8	11
6	0	18
7	0	17
8	45	14
9	38	9
10	153	12
11	22	29
12	111	30
13	16	53
14	316	120
15	1116	227
16	1672	349
17	2249	546
18	3997	731
Total	9981	2251

* Data from 2009.

• Data from 2007.

From: National Center for Injury Prevention and Control WISQARS.

2007, United States homicide ages 1 to 18, all races, both sexes



Total deaths: 2285.

#: percent.

Reproduced from: National Center for Injury Prevention and Control WISQARS™
 (<http://www.cdc.gov.ezproxylocal.library.nova.edu/injury/wisqars/fatal.html>). Accessed on August 8, 2011.

Haddon's injury control model for firearm injuries

Event stages	Epidemiological factors			
	Human factor	Agent or vehicle	Physical environment	Sociocultural/political environment
Pre-event	Gun safety programs for children Family counseling	Remove firearms from home Loaded chamber indicator Magazine disconnect device Trigger locks Personalized gun	Lock boxes Store ammunition separately	Regulation of handguns and assault weapons Regulation of firearms as a consumer product
Event	Bulletproof vest	Safer bullet	Safe firearm practice ranges	
Post-event	---	---	---	Surveillance and analysis of firearm injuries to identify risk factors, causes, and possible prevention strategies

Firearm safety tips

Any gun is a potential danger to children in the home; the risks must be seriously considered.

Firearms should be stored unloaded, locked up, and out of children's reach.

Ammunition should be stored in a separate, locked location.

Quality gun locks, lock boxes, or gun safes should be used on every firearm. When correctly installed, gun locks prevent firearms from being discharged unless the lock is removed.

Gun storage keys and lock combinations should be kept hidden in a location separate from the guns.

Parents who have guns should take a course in using, maintaining, and storing them safely.

Parents should talk to their children about the dangers of guns and teach their children never to touch or play with a gun.

Children should be taught to tell an adult if they find a gun, or, if no adult is present, to call 911 or the local emergency number.

Check with neighbors, friends, relatives, and adults in other homes where the child visits to make sure that if they have firearms in the home, they follow safe storage practices.

Data from: The National Safe Kids Campaign. Firearms: Protecting your family. Available at: www.usa.safekids.org/tier3_cd.cfm?content_item_id=315&folder_id=172 (Accessed on April 28, 2008).