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Deaths Due to Firearms Injuries in Children

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ABSTRACT: There has been a marked increase in firearms-related deaths in this country over the past several decades. Especially in urban areas this increase has been correlated with a greater availability of handguns. Children have become more common victims of gunfire. Both accidental and homicidal shooting deaths have increased in the lower age groups. We examined deaths due to gunfire in children ten years and younger in Cook County, Illinois, which contains the large city of Chicago. Homicidal shootings predominated in this age group with the most common circumstances being a child struck by a stray bullet. Accidental shooting deaths always occurred when one or more children were playing with a gun they found in the home.

KEYWORDS: pathology and biology, deaths, firearms injuries, children

The dramatic increase in firearms-related deaths in this country over the past three decades has been documented and analyzed extensively. Over 30,000 individuals are killed by firearms each year in the United States. Young children make up a small but significant percentage of the total number of fatalities—nearly 2% of all victims killed by firearms are less than 15 years of age [1-4]. This article reviews deaths due to firearms in children 10 years of age and under in Cook County, Illinois during the period 1984-1992. Our objective is to examine firearm-related deaths early in life in a large urban community. Hopefully a better understanding of this problem will aid in the prevention of future deaths of this type.

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Materials and Methods

We reviewed the records of the Cook County Medical Examiner's Office over the nine years of 1984 through 1992. Over this period our office performed approximately 32,400 autopsies of which 45 were deaths in children ten years and younger due to firearms injuries. In each of these cases we performed a complete external and internal examination of the body, investigated the circumstances surrounding the death, and reviewed all available medical records.

Findings

- There were 35 (78%) male and 10 (22%) female victims 10 years of age or less.
- Blacks accounted for 35 (78%) of the cases and whites for 10 (22%) deaths.
- In 24 (53%) cases the victims were under 6 years of age and in 21 cases (47%) they were between 6 and 10 years. There was a roughly bimodal distribution of deaths by age—the most common ages were 4 years and 10 years (Fig. 1).
 - The most common anatomic site for single fatal gunshot wounds in our study was the head with 34 (76%) cases. Deaths were also caused by single wounds of the chest in five cases (11%), neck in two cases (4%), abdomen in one case (2%), and back in one case (2%), as well as multiple gunshot wounds in two cases (4%).
 - Deaths in our study appeared to increase over the period 1984–1992 with a dramatic increase in 1992 (Fig. 2).
 - The frequency of deaths in our study was generally higher in the summer months with the most cases occurring in July and September.
 - The frequency of death by time of day was slightly higher during the evening hours with 14 (31%) cases occurring between 6:00 P.M. and midnight.
 - A handgun was the most common weapon and was involved in 40 (89%) cases. Other weapons included rifles in three (7%) cases and air rifles in two (4%) cases. No deaths were due to shotguns.
 - Among the 45 total cases in our study, 31 (69%) were homicides and 14 (31%) were accidents.
 - Most homicides occurred in the home—there were 19 such cases. Other sites included the street in eight cases, the yard in two cases, the school in one case, and the lake-front in one case.
 - All accidental shooting deaths occurred in the home.
 - In homicides the relationship between the shooter and the victim was not known in 14 cases. A parent or step-parent was the shooter in six cases, a stranger in five cases, a family friend in three cases, a brother in two cases, and an uncle in one case.
 - In accidents the shooter was always an acquaintance whether relative, friend, or self.
 - In homicides the victim was struck by a stray bullet in 14 cases, shot intentionally in twelve cases, and shot by an adult playing with or recklessly handling a gun in five cases.
 - In accidents the victim was always shot as a result of a child or children playing with a gun.

Discussion

There are estimated to be nearly 200 million firearms in the United States. Fatalities due to these weapons are ranked nationally as the eighth leading cause of death [1,2,4]. The problem of death due to gunfire in the lower age groups is related to but distinct

GUNSHOTS IN CHILDREN COOK COUNTY: 1984-92

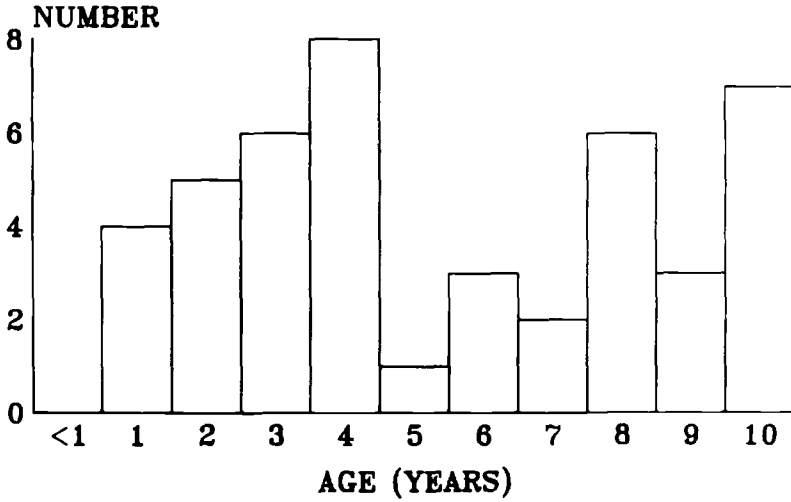


FIG. 1—Age distribution of pediatric firearms deaths.

GUNSHOTS IN CHILDREN COOK COUNTY: 1984-92

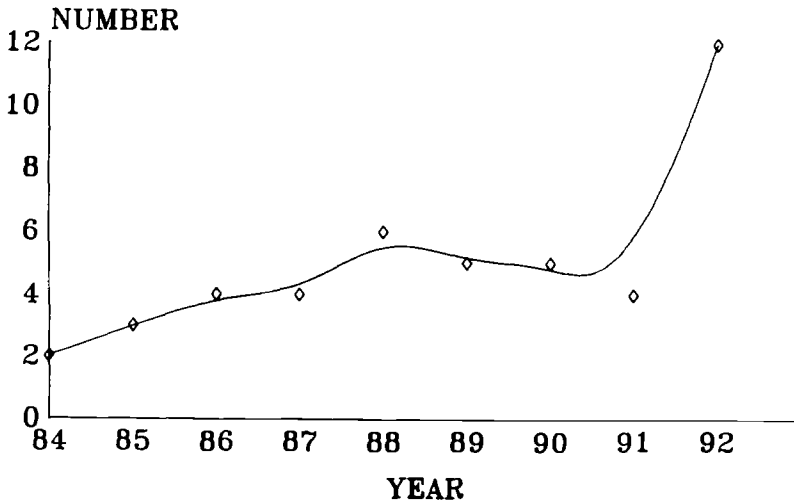


FIG. 2—Yearly totals of gunshot wound deaths over period 1984-1992.

from the population in general [5–33]. Children generally are innocent victims, whereas adults often have some choice concerning their associates, activities and surroundings.

A child may be shot intentionally by an adult, as a bystander to home or street violence, or by an adult carelessly handling a firearm. Also children may be killed when playing with loaded guns—often weapons purchased for home protection. Both homicidal and accidental shootings of children in the United States have become more common as firearm availability has increased [7,10,11,16–18,22,23,25–27,29,32]. Researchers in this area have looked at the topic of firearms injuries in the pediatric age group from various perspectives. Our study deals specifically with firearms fatalities in children ten years of age and under—the very young who have died due to wounds from guns.

The male to female ratio in our study was approximately 3:1. This value was the same as that reported in a recent Maryland study by Beaver et al. of pediatric firearms fatalities in the somewhat older age group of persons 16 years of age and under [29].

Slightly more than half of our cases were under five years of age and slightly less than half were between five years and ten years of age. Because of this roughly bimodal distribution of cases with peaks at four and ten years of age, we extended our series slightly past the one to nine year group generally studied by epidemiologists. Other studies of pediatric gunshot injuries by Barlow et al. from New York City [9], by Ordog et al. from Los Angeles [26], and by Valentine et al. from Dallas [17] do not show the same distribution as our series. Those researchers show single peaks at eight to nine years [9], nine years [26] and eight years [17], respectively. Studies that include older children show a marked increase beginning at twelve years of age [9,17]. We have no explanation at this time for the two peaks found in our series.

Beaver's group found, as we did, that the most common anatomic site of fatal firearms injury was the head (62%). One possible explanation for this finding is that a young child's head is proportionately larger than that of a fully grown person and therefore presents a bigger target [29]. Also, firearms injuries to the head have a very high likelihood of causing death.

There was a gradual increase in the number of deaths in our study over the period 1984 through 1991 and a marked increase in the year 1992 when there were 12 cases. We could find no single factor that explained this trend. In one of the earliest studies on this topic, Heins et al. reviewed children 15 years of age and younger treated for gunshot wounds at Detroit General Hospital and found a marked increase in the number of children shot in the late 1960s. They related the surge to increasing numbers of guns bought and kept in the home for protection following episodes of civil unrest [6]. Other studies of shootings in the pediatric age group have reported an increased incidence in the last decade [9,25,26]. In a recent review of gunshot wounds in children under ten years of age from the Los Angeles area, Ordog et al. found that the incidence of gunshot wounds in 1987 was twice that in 1980 [26]. They related the increase to gang violence and retaliation, availability of handguns in the home, and the neglect of young children [26]. We agree that these factors probably also contribute to the increasing numbers of children killed by firearms in Cook County.

In our series, fatal gunshot wounds in young children were most common during the warmer months of June, July, August, and September. Barlow et al. from New York City also found a slight predominance (30%) of pediatric gunshot wounds in the summer months [9]. Though most of the deaths we report occurred inside the home, a substantial number were children struck by stray bullets while outdoors. Such outdoor shootings may be more common during the warmer months because children are not in school and are more often playing outside. Also, during the summer months, violent encounters between adults and the random firing of guns may be more likely to occur outdoors.

We found fatal shootings in our series to be most common in the later afternoon and early evening. This pattern suggests that school may offer some protection against fire-

arms violence during the day. Paulson and Rushforth, studying pediatric homicides, which were predominantly due to guns, in Cuyahoga County, Ohio, also propose a link between the lower death rates they found during the day and school attendance. They noted that while homicide rates for children 15 years of age and younger dropped after 9:00 PM, the frequency of homicides in persons 15 to 19 years of age peaked at midnight and remained high until 3:00 AM. This distribution suggests sleep may also decrease children's vulnerability to violence. We too found children less likely to be killed by firearms in the late evening and very early morning when they are usually in bed. But we did have several cases in which children were shot while they slept.

The most frequently involved firearm in our series was a handgun. A statewide California study by Wintemute et al. of accidental childhood shooting fatalities 14 years of age and under also found that handguns predominated (58%) [24], as did the previously mentioned study by Beaver et al. (48%) [29]. However, in a study from Oklahoma by Keck et al. that reviewed accidental deaths due to firearms in persons younger than 20 years, rifles and shotguns were more frequently used (56%) than handguns (34%). The authors attributed this finding to long guns being more common than pistols in the rural counties where about 80% of their firearms deaths occurred [27]. Golladay et al. also reviewed pediatric fatal and non-fatal firearms injuries from the relatively rural state of Arkansas and found shotgun wounds accounted for one third of their cases [31].

Homicide was the most common classification of death in our series. Beaver et al. also found that homicide predominated at a ratio similar to ours of approximately 2:1 [29]. When we looked at deaths in young children due to gunshot wounds at our office a decade ago, accidental firearm deaths were the most common classification—over half the victims killed were shot by other young children in the home [13]. This change in the percentage contribution of firearm homicides to the overall firearm mortality in the pediatric age group in our county appears to be due to an increasing number of children struck by stray bullets from shootings as well as children intentionally shot by adults.

According to our data the home was the most common location for homicidal pediatric firearms fatalities—all our accidental shootings occurred there. Beaver et al. from Maryland also found most pediatric firearms fatalities occurred at home (60%). In their study other locations included the street (10%), woods, (7%), unknown (4%), automobile (3%), and school (1%) [29]. Schikler and Jones from Louisville, Kentucky found the home to be the most common place for accidental shooting of children 16 years of age and under (66%). However, in their study homicides were more likely to occur in the street (57%) than the home or other locations [16].

Homicides

Disturbingly, homicide rates in the United States for the pediatric age group have increased over the past 30 years though overall death rates for children have declined [14,22]. Homicide in children has been divided by Jason et al. into two broad categories—intrafamilial homicide in which the victim is a very young child, the perpetrator is another family member, and the cause of death is usually blunt trauma; and extrafamilial homicide in which the child is generally over five years of age, the perpetrator is from outside the family and the death is most often caused by firearms injuries [12]. A subcategory of intrafamilial childhood homicide, infanticide, (victims less than 1 year of age) has also been described by Christoffel [14].

The most common set of circumstances under which homicidal pediatric firearms fatalities occurred in our series were extrafamilial homicides in which the child was struck by a stray bullet. Intrafamilial homicides were slightly less common. In these cases the shooter was most often a parent or step parent. The following cases are two typical examples from our series:

Case 1 (Extrafamilial Homicide)—A three-year-old boy was standing at the window of the family's apartment when he was struck by a bullet that had passed through the open window. Two men outside had been firing handguns into the air. At autopsy there was a typical gunshot wound of entrance on the back of the head. The weapon involved was a 9 mm semi-automatic pistol.

Case 2 (Intrafamilial Homicide)—A four-year-old girl was found lying on the living room floor of her family's apartment. The father of the victim, a 26-year-old man released on bond, had shot the victim, another child, and then himself with a .38 caliber revolver. At autopsy, the victim had a single close-range gunshot wound of the lip with surrounding powder stippling (Fig. 3).

Accidents

According to our findings and other studies most accidental pediatric firearms fatalities occur when children play with loaded guns [18,23,24,26,32]. When children in our study shot themselves or each other the cases were classified as accidents. Suicides in the age group we studied are extremely rare—we had only two cases at our office during the period 1984 to 1992 and both were due to hanging. Generally, we reason that very young children are unlikely to distinguish between real and toy guns or to fully comprehend the concept of death. Though children may not fully appreciate the danger of firearms, however, they have apparently become sufficiently familiar with the method of firing them, very possibly through television, movies and toys [8]. The following is an example of a typical accidental case from our series.

Case 3 (Accident)—A two-year-old girl was playing with her two brothers, aged six years and four years, in the bedroom of their apartment while their grandfather was eating breakfast in the kitchen. She was killed when the 6-year-old found a .38 caliber revolver under the grandfather's mattress and fired one shot which struck her in the face. At autopsy she had a single gunshot wound of the nose with surrounding powder stippling on the cheek.



FIG. 3—Photograph of powder tattooing surrounding gunshot wound of upper lip in Case 2.

Conclusion

In our study of children ten years of age and younger who died of firearms injuries in Cook County, Illinois, during the period 1984 to 1992 the victim was most likely to be a black male. The most common anatomic site of the fatal injury was the head. Pediatric firearms deaths increased in Cook County over the period we studied with a dramatic rise in 1992. Though accidental shooting deaths in this age group were more common at our office during the late 1970s and early 1980s, homicidal shootings now predominate. We found the most likely weapon to be a handgun and the most likely location for injury to be the home. Fatal shootings of children in Cook County generally occurred in the afternoon or evening during the summer months or early fall. When the death was a homicide the child most frequently was struck by a stray bullet or shot intentionally by an adult. When the death was accidental, the fatal incident always occurred when one or more children were playing with a gun they found in the home.

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References

- [1] "Firearms Injuries and Deaths: A Critical Public Health Issue," *Public Health Reports*, Vol. 104, No. 2, Mar.-Apr. 1989, pp. 111-120.
- [2] Wintemute, G. J., "Firearms As a Cause of Death in the United States, 1920-1982," *The Journal of Trauma*, Vol. 27, No. 5, May 1987, pp. 532-536.
- [3] Christoffel, K. K., "Toward Reducing Pediatric Injuries from Firearms: Charting a Legislative and Regulatory Course," *Pediatrics*, Vol. 88, No. 2, Aug. 1991, pp. 294-305.
- [4] Wintemute, G. J., Teret, S. P., and Krause, J. F., "The Epidemiology of Firearm Deaths Among Residents of California," *Western Journal of Medicine*, Vol. 146, No. 3, March 1987, pp. 374-377.
- [5] Izant, R. J. and Hubay, C. H., "The Annual Injury of 15,000,000 Children: A Limited Study of Childhood Accidental Injury and Death," *The Journal of Trauma*, Vol. 6, No. 1, Jan. 1966, pp. 65-74.
- [6] Heins, M., Kahn, R., and Bjordnal, J., "Gunshot Wounds in Children," *American Journal of Public Health*, Vol. 64, No. 4, Apr. 1974, pp. 326-330.
- [7] Rushforth, N. B., Hirsch, C. S., Ford, A. B., and Adelson, L., "Accidental Firearm Fatalities in a Metropolitan County (1958-1973)," *American Journal of Epidemiology*, Vol. 100, No. 6, June 1974, pp. 499-505.
- [8] Rothenberg, M. B., "Effect of Television Violence on Children and Youth," *Journal of the American Medical Association*, Vol. 234, No. 10, Dec. 1975, pp. 1043-1046.
- [9] Barlow, B., Niemirska, M., and Gandhi, R., "Ten Years' Experience with Pediatric Gunshot Wounds," *Journal of Pediatric Surgery*, Vol. 17, No. 6, Dec. 1982, pp. 927-932.
- [10] Jason, S., "Child Homicide Spectrum," *American Journal of Diseases of Children*, Vol. 137, No. 6, June 1983, pp. 578-581.
- [11] Christoffel, K. K., Keating, N. K., and Amari, M., "Homicide in Childhood: Distinguishable Patterns of Risk Related to Developmental Levels of Victims," *The American Journal of Forensic Medicine and Pathology*, Vol. 4, No. 2, June 1983, pp. 129-137.
- [12] Jason, J., Gilliland, J. C., and Tyler, C. W., "Homicide As a Cause of Pediatric Mortality in the United States," *Pediatrics*, Vol. 72, No. 2, Aug. 1983, pp. 191-197.
- [13] Lifschultz, B. D. and Kirschner, R. H., "Handgun Firearm Deaths in Children," *The Medical Council on Handgun Violence: Update*, Nov. 1983, p. 3.
- [14] Christoffel, K. K., "Homicide in Childhood: A Public Health Problem in Need of Attention," *American Journal of Public Health*, Vol. 74, No. 1, Jan. 1984, pp. 68-70.
- [15] Nelson, K. G., "The Innocent Bystander: The Child As Unintended Victim of Domestic Violence Involving Deadly Weapons," *Pediatrics*, Vol. 73, No. 2, Feb. 1984, pp. 251-252.
- [16] Schikler, K. and Jones, M. P., "Gunshot Wounds in Children: A Preventable Disease," *Journal of the Kentucky Medical Association*, Feb. 1984, pp. 63-65.
- [17] Valentine, J., Blocker, S., and Chang, J. H. T., "Gunshot Injuries in Children," *The Journal of Trauma*, Vol. 24, No. 11, Nov. 1984, pp. 952-956.

- [18] Schetky, D. H., "Children and Handguns," *American Journal of Diseases of Children*, Vol. 139, No. 3, March 1985, pp. 229-231.
- [19] Christoffel, K. K. and Christoffel, T., "Handguns: Risks versus Benefits," *Pediatrics*, Vol. 77, No. 5, May 1986, pp. 781-782.
- [20] Kellerman, A. L. and Reay, D. T., "Protection or Peril? An Analysis of Firearm-Related Deaths in the Home," *The New England Journal of Medicine*, Vol. 314, No. 24, June 1986, pp. 1557-1560.
- [21] Boyd, J. H. and Moscicki, E. K., "Firearms and Youth Suicide," *American Journal of Public Health*, Vol. 76, No. 10, Oct. 1986, pp. 1240-1242.
- [22] Paulson, J. A. and Rushforth, N. B., "Violent Death in Children in a Metropolitan County: Changing Patterns of Homicide, 1958 to 1982," *Pediatrics*, Vol. 78, No. 6, Dec. 1986, pp. 1013-1020.
- [23] Patterson, P. J. and Smith, L. R., "Firearms in the Home and Child Safety," *American Journal of Diseases of Children*, Vol. 141, No. 2, Feb. 1987, pp. 221-223.
- [24] Wintemute, G. J., Teret, S. P., Kraus, J. F., Wright, M. A., and Bradford, G., "When Children Shoot Children: 88 Unintended Deaths in California," *Journal of the American Medical Association*, Vol. 257, No. 22, June 1987, pp. 3107-3109.
- [25] Ordog, G. J., Prakash, A., Wasserberger, J., and Balasubramanian, S., "Pediatric Gunshot Wounds," *The Journal of Trauma*, Vol. 27, No. 11, Nov. 1987, pp. 1272-1278.
- [26] Ordog, G. J., Wasserberger, J., Schatz, I., Owens-Collins, D., English, K., Balasubramanian, S., and Schlater, T., "Gunshot Wounds in Children Under 10 Years of Age: A New Epidemic," *American Journal of Diseases of Children*, Vol. 142, No. 6, June 1988, pp. 618-622.
- [27] Keck, N. J., Istre, G. R., Cury, D. L., Jordan, F., and Eaton, A. P., "Characteristics of Fatal Gunshot Wounds in the Home in Oklahoma: 1982-1983," *American Journal of Diseases of Children*, Vol. 142, No. 6, June 1988, pp. 623-626.
- [28] Miner, M. E., Ewing-Cobbs, L., Kopaniky, D. R., Cabrera, J., and Kaufmann, P., "The Results of Treatment of Gunshot Wounds to the Brain in Children," *Neurosurgery*, Vol. 26, No. 1, Jan. 1990, pp. 20-25.
- [29] Beaver, B. L., Moore, V. L., Peciet, M., Haller, J. A., Jr., Smialek, J., and Hill, J. L., "Characteristics of Pediatric Firearm Fatalities," *Journal of Pediatric Surgery*, Vol. 25, No. 1, Jan. 1990, pp. 97-100.
- [30] Stucky, W. and Loder, R. T., "Extremity Gunshot Wounds in Children," *Journal of Pediatrics*, Vol. 11, No. 1, Jan. 1991, pp. 64-71.
- [31] Golladay, E. S., Murphy, K. E., and Wagner, C. W., "Shotgun Injuries in Pediatric Patients," *Southern Medical Journal*, Vol. 84, No. 7, July 1991, pp. 886-888.
- [32] "Unintentional Firearm-Related Fatalities Among Children and Teenagers—United States, 1982-1988," *Morbidity and Mortality Weekly Report*, Vol. 41, No. 25, June 26, 1992, pp. 442-451.
- [33] Hall, J. R., Reyes, H. M., Meller, J. L., and Stein, R. J., "Traumatic Death in Urban Children, Revisited," *American Journal of Disease of Children*, Vol. 147, No. 1, Jan. 1993, pp. 102-107.

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