

James R. Gill,<sup>1</sup> M.D.; Kelly A. Lenz,<sup>2</sup> B.S.; and May Jennifer Amolat<sup>3</sup> M.D., M.F.M.

## Gunshot Fatalities in Children and Adolescents in New York City

**ABSTRACT:** We reviewed the case records of all fatalities due to gunshot wounds in children and adolescents under 19 years of age in New York City from 1996 to 2000. The epidemiological profile, circumstances, toxicology results, location, and injuries were examined. There were 263 deaths: 242 homicides, 17 suicides, and 4 accidents. Among the homicides, 96% involved Black or Hispanic and 68% involved 17 and 18-year-old decedents. There were 11 times as many male as female homicides. The detection of ethanol and/or illicit drugs was 56% in the homicide and 53% in the suicide groups. Suicide notes were found in 18% of suicides, and an additional 35% verbally expressed a plan to commit suicide. Most suicides (77%) were in the home and half of the homicides occurred on the street.

**KEYWORDS:** forensic science, forensic pathology, gunshot wound, children, New York City

Injury in the pediatric population is the leading cause of death and of premature years of life lost in the United States (1,2). Approximately 10,000 children die of traumatic causes each year (1). Firearm injuries are second only to motor vehicle collisions in causing traumatic deaths in the United States and have been predicted to exceed the rate of fatalities due to motor vehicle collisions by 2003 (3). The impact of firearm morbidity and mortality on the pediatric population in the United States is profound and exceeds rates of most other countries (4–12). A child in the United States between 4–15 years old faces an unintentional firearm-related death rate that is nine times higher, a firearm suicide rate that is ten times higher and a firearm homicide rate that is 17 times higher than his peers in other developed nations (13).

A better understanding of the epidemiology and circumstances of firearm injuries will give professionals the tools necessary to intervene, affect the risk behaviors and factors, and prevent such fatalities. This study will examine patterns of injury, toxicology, and circumstances and their associations with the manner of death, age, gender, and race.

### Materials and Methods

The Office of Chief Medical Examiner investigates all unexpected, violent, and suspicious deaths in the five boroughs that comprise New York City. All deaths from gunshot wounds under 19 years of age between 1996 and 2000 were identified through the New York City Office of Chief Medical Examiner (OCME) database using the age and a textword search for “gunshot.” Decedents with other injury modalities (blunt or sharp injury) were excluded if the

gunshot wound was not the sole cause of death. Deaths due to the delayed complications of gunshot injuries were included.

All case files were reviewed including: the autopsy, toxicology, and investigators’ reports. In select instances, police reports, scene and autopsy photographs/diagrams, and medical records were reviewed. The age, race, sex, injuries (number, location, type), circumstances, medical history, location, toxicology results, and cause and manner of death were extracted. The race of the decedent is that provided by the next of kin on the identification form.

The range of fire was reported as contact, close (fouling and stippling), intermediate (stippling without fouling), distant (no fouling or stippling), or indeterminate (no fouling or stippling) due to prolonged hospitalization.

Toxicological testing was performed on all deaths. Specimens routinely collected for toxicological analysis include: blood, urine, bile, vitreous humor, brain, liver, and gastric contents. Autopsy blood specimens were collected with the addition of sodium fluoride and stored at 4°C. The toxicology laboratory at the Office of Chief Medical Examiner analyzed all specimens. Ethanol concentrations were determined in blood (and vitreous or urine if available) using head space gas chromatography.

Urine specimens were routinely tested for opiates, barbiturates, benzoylcegonine (BE), cannabinoids, amphetamines, phencyclidine, and methadone by enzyme immunoassay. In cases where urine was not available, blood was tested for opiates, benzoylcegonine, barbiturates, and cannabinoids by radioimmunoassay. Urine or blood also was screened for basic drugs (including ketamine and cocaine) by gas chromatography with a nitrogen phosphorous detector (GC/NPD).

### Results

In this five-year period in New York City, there were 263 pediatric deaths due to gunshot wounds including: 242 homicides, 17 suicides, and 4 accidents. The age range was 2 to 18 years for homicides (mean 16.5 years) and 13 to 18 for suicides (mean 16.5 years). The majority of homicides (68%) involved 17–18 year olds. There were more males than females for both homicides (11 to 1)

<sup>1</sup> New York City Office of Chief Medical Examiner, 520 First Avenue, New York, NY and Department of Forensic Medicine, New York University School of Medicine, New York, NY.

<sup>2</sup> New York City Office of Chief Medical Examiner, New York City Multidisciplinary Child Fatality Review, 520 First Avenue, New York, NY 10016.

<sup>3</sup> Department of Pathology, Mount Sinai Medical Center, One Gustave L. Levy Place, New York, NY.

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and suicides (16 to 1). Black (72%) and Hispanic (24%) decedents made up 96% of the homicides (Table 1).

Deaths due to a single gunshot wound occurred in 59% (143/242) of the homicides and 100% (17/17) of the suicides. Of the single gunshot wound homicides, 51% involved injuries of the head and 48% of the trunk. The majority of homicidal gunshot wounds (73%) were distant while 76% of suicidal gunshot wounds were contact (see Table 2).

The toxicological and psychiatric findings are presented in Table 2. The detection of ethanol and/or illicit drugs was 56% (118/210) in the homicide group and 53% (8/15) in the suicide group. Among homicides, ethanol was detected in 14% and illicit drugs were detected in 48%. The illicit drugs were predominately cannabinoids (98 decedents), followed by cocaine (nine decedents), and phencyclidine (two decedents). Among suicides, cannabinoids were detected in 7 and cocaine in a single fatality. Due to prolonged survival intervals, toxicologic results of 13% of the homicides and 12% of the suicides were excluded because they did not represent the toxicologic state at the time of the injury (see Table 2). Suicide notes were found in 11% of suicides, and an additional 35% verbally expressed a plan to commit suicide. Most homicides occurred on the street (50%) and most suicides were in the home (77%). Overall, 23% of all deaths occurred at home.

The four accidental deaths (1.5% of all manners) involved two deaths during "Russian roulette" and two while "playing with a gun." One decedent was positive for ethanol (0.06 g%) and one

was positive for cannabinoids. Investigation of the circumstances of these four deaths strongly favored accidents and not suicide or homicide.

## Discussion

The vast majority of pediatric and adolescent gunshot fatalities in New York City were homicides. This study concentrates on three important areas of death investigation: toxicology, epidemiology, and patterns of injury.

The toxicologic analyses show that ethanol and/or illicit drugs were detected in over half of the homicides and suicides. This result is similar to findings in a study by Galea et al. that examined intoxications among firearm deaths in New York City from 1990–1998 (14). They found that drugs of abuse were detected in over half of the decedents. The rates of detection varied by race and year; however, ethanol (27%), cocaine (24%), and cannabinoids (20%) were most frequently detected. They did not examine the toxicology findings by age, but in our pediatric data, cannabinoids (47%) were more frequently detected than cocaine (4%). Galea et al. noted a decrease in cocaine and cannabinoid-positive deaths in the late 1990s as the homicide rate also decreased (14). This decrease may be due to changes in patterns of drug abuse and/or a greater use of cannabinoids among youths. A study of pediatric firearm injuries from 1960 to 1993 in northern Manhattan, found that up to 60% of the patients tested positive for cannabinoids (15).

TABLE 1—*The age, race, and sex results by manner of death.*

	Homicides	Suicides	Accidents	Total	Population*
Age Range (mean)	2–18 (16.5)	13–18 (16.5)	14–18 (16.3)	2–18 (16.5)	
Male	221	16	4	241	
Female	21	1	0	22	
Asian	2 (1%)	0	0	2	189,466
Black	175 (72%)	7 (41%)	4 (100%)	186	626,604
Hispanic	57 (24%)	7 (41%)	0	64	733,875
White	8 (3%)	3 (18%)	0	11	509,317
Total	242 (100%)	17 (100%)	4 (100%)	263	2,568,579

\* Vital Statistics 2000, Office of Vital Statistics, New York City, NY.

TABLE 2—*Gunshot wound injuries, toxicology, and intent by manner of death.*

	Homicides	Suicides	Accidents
Total fatalities due to gunshot wounds	242	17	4
Gunshot wound injuries per person (mean)	1–11 (2.1)	1 (1)	1 (1)
Persons with 1/2/3 or more gunshot wounds	143/38/61	17/0/0	4/0/0
Range of Fire:			
Contact	16	13	3
Close	7	2	0
Intermediate	27	0	1
Distant	176	0	0
Indeterminate	16	2	0
Location of Single Gunshot Wounds:			
Head	73	16	4
Trunk	68	1	0
Extremity	2	0	0
Suicide Note and/or Verbal Expression	0	53% (9/17)	0
Ethanol and/or Illicit Drugs*	56% (118/210)	53% (8/15)	50% (2/4)

\* Due to prolonged hospitalization, the toxicology results of 13% of homicides and 12% of suicides were excluded because they do not reflect the toxicologic state at the time of the injury.

Among adolescent firearm deaths (13–18 years), ethanol was detected in 14% of the New York City homicides compared to 21% in Cape Town South Africa (16). Variations in survival intervals or social aspects of ethanol use may account for these differences. Ethanol and substance abuse are risk factors for firearm deaths beginning in adolescence.

The epidemiology of these deaths demonstrates the substantial difference in firearm deaths among ethnic groups. As in other studies, Blacks, Hispanics, and men and older teenagers made up the majority of the firearm deaths (6,9,16–22). Nationally, the risk of death by firearms is greater for males (18.3/100,000) than females (2.9/100,000) (23). Although deaths of young children are often reported in the popular press, the vast majority of these “pediatric” deaths involve older teenagers. A study of drive-by-shootings in Los Angeles among children and adolescents, found all decedents were Black or Hispanic and 97% were male (19). Gang violence clearly plays a role in pediatric firearm deaths (24,25). The predominance of homicides in the pediatric group, however, has been demonstrated in both urban and non-urban settings (9,16).

The patterns of injury include range of fire, number of injuries, and body location of injuries. The majority of homicides were distant range (79%) and all suicides were contact (76%), close range (12%), or indeterminate range (12%) due to prolonged hospitalizations. The majority of homicides had a single gunshot wound (59%) and of these 51% involved the head. Other studies have demonstrated similar wounding patterns (15,19,26). A study in Los Angeles found that 69% of deaths were due to a single gunshot wound (19) and a study of pediatric firearm deaths in Maryland reported that 62% of all firearm deaths were due to gunshot wounds of the head (26).

Most pediatric and adolescent firearm deaths in New York City occurred on the street although in Maryland, 75% of the deaths occurred at home (26). This disparity is most likely due to the variation in the manner of death between the two groups. Under half of Maryland’s death were homicides and they did not include fatalities of 17 and 18 year olds. The higher number of accidents and suicides, which often occur in the home, account for the difference.

Of the 132 pediatric deaths in Maryland, 33 (25%) were certified as accidents (26). In New York City, only 4 (1.5%) of 263 deaths were certified as accidents. These differences may be due to the more rural geography of Maryland with areas of legal hunting. This is further supported by the finding that long guns were involved in nearly 40% of the Maryland deaths. Regional variations in criteria for death certification may also play a role. Interestingly, suicides also were more prevalent in rural or non-metropolitan areas as evidenced in the Kentucky and Alaska studies (21,27). Previous studies have shown that firearms in the home and a high gun density within the state correlate with firearm homicide and suicide rates in adults and adolescents (8,28–30).

It is imperative that public health professionals and others involved in the investigation and adjudication of firearm-related deaths take an active role and intervene in an epidemic that has been acknowledged but has not been effectively addressed. Increased attention must be invested to impact populations who are at risk. Limited efforts have been implemented to reduce effectively the incidence of injuries associated with firearms in comparison with other preventable injuries such as motor-vehicle-related injury (3).

There have been numerous public health publications on the prevalence of pediatric firearm injuries (4,7,18,31). Interventions have included addressing individual gun owners, legislation, and enforcing stricter safety standards and liability on gun manufactur-

ers and distributors (32). In addition there have been anti-violence campaigns and promotion of gun-safe homes using school, community, and health care groups. Although this issue is not easily extricated from its social and economic milieu, greater and standardized information can help formulate policy and guide preventive practice such as what has been done for improving motor vehicle safety. A better understanding of the epidemiology and circumstances of firearm injuries will give professionals the tools necessary to intervene and affect the risk behaviors and factors. An aggressive and multidimensional approach in protecting this particularly vulnerable segment in our population is paramount.

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Additional information and reprint requests:  
James R. Gill, M.D.  
Deputy Chief Medical Examiner, Bronx County  
City of New York  
Office of Chief Medical Examiner  
520 First Avenue  
New York, NY 10016