

School-Associated Violent Deaths in the United States, 1994-1999

Mark Anderson, MD, MPH

Joanne Kaufman, PhD

Thomas R. Simon, PhD

Lisa Barrios, DrPH

Len Paulozzi, MD

George Ryan, PhD

Rodney Hammond, PhD

William Modzeleski, MS

Thomas Feucht, PhD

Lloyd Potter, PhD, MPH

and the School-Associated Violent Deaths Study Group

IN THE LATTER HALF OF THE 1990s, the United States experienced a series of high-profile school shootings that generated considerable media attention and public alarm. Despite the intense interest, relatively little information has been collected on violent deaths associated with schools. These deaths are not routinely reported to state or federal agencies and cannot be identified using traditional public health or criminal justice data sources.¹ In 1996, the Centers for Disease Control and Prevention (CDC), in conjunction with the US Departments of Education and Justice, published the first systematic review of school-associated violent deaths, covering 2 academic years (1992-1993 and 1993-1994).¹ However, many highly publicized incidents of school violence have occurred since then.²⁻⁸ More recent reports have examined violent deaths associated with schools, including the highly publicized events mentioned, but these reports were restricted by either the limited data

See also Patient Page.

Context Despite the public alarm following a series of high-profile school shootings that occurred in the United States during the late 1990s, little is known about the actual incidence and characteristics of school-associated violent deaths.

Objective To describe recent trends and features of school-associated violent deaths in the United States.

Design, Setting, and Subjects Population-based surveillance study of data collected from media databases, state and local agencies, and police and school officials for July 1, 1994, through June 30, 1999. A case was defined as a homicide, suicide, legal intervention, or unintentional firearm-related death of a student or nonstudent in which the fatal injury occurred (1) on the campus of a public or private elementary or secondary school, (2) while the victim was on the way to or from such a school, or (3) while the victim was attending or traveling to or from an official school-sponsored event.

Main Outcome Measures National estimates of risk of school-associated violent death; national trends in school-associated violent deaths; common features of these events; and potential risk factors for perpetration and victimization.

Results Between 1994 and 1999, 220 events resulting in 253 deaths were identified; 202 events involved 1 death and 18 involved multiple deaths (median, 2 deaths per multiple-victim event). Of the 220 events, 172 were homicides, 30 were suicides, 11 were homicide-suicides, 5 were legal intervention deaths, and 2 were unintentional firearm-related deaths. Students accounted for 172 (68.0%) of these deaths, resulting in an estimated average annual incidence of 0.068 per 100 000 students. Between 1992 and 1999, the rate of single-victim student homicides decreased significantly ($P = .03$); however, homicide rates for students killed in multiple-victim events increased ($P = .047$). Most events occurred around the start of the school day, the lunch period, or the end of the school day. For 120 (54.5%) of the incidents, respondents reported that a note, threat, or other action potentially indicating risk for violence occurred prior to the event. Homicide offenders were more likely than homicide victims to have expressed some form of suicidal behavior prior to the event (odds ratio [OR], 6.96; 95% confidence interval [CI], 1.96-24.65) and been bullied by their peers (OR, 2.57; 95% CI, 1.12-5.92).

Conclusions Although school-associated violent deaths remain rare events, they have occurred often enough to allow for the detection of patterns and the identification of potential risk factors. This information may help schools respond to this problem.

JAMA. 2001;286:2695-2702

www.jama.com

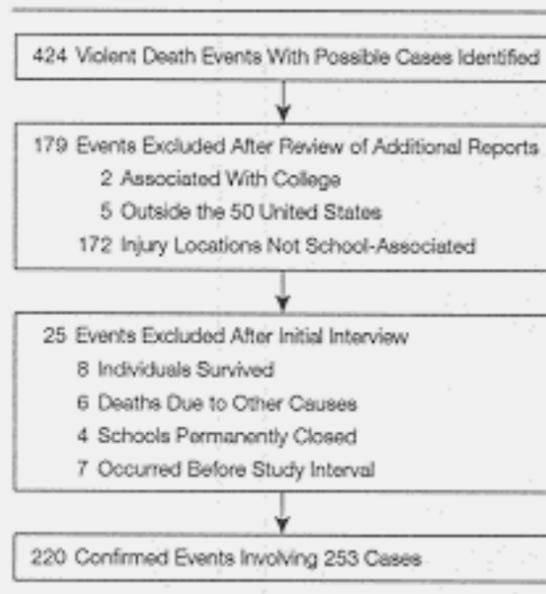
collected on each event⁹ or small, non-random samples.¹⁰⁻¹⁵

The current study is an extension and expansion of the prior CDC study. To our knowledge, it is also the only systematic investigation of all recent school-associated violent deaths in the United States between 1994 and 1999. The study was undertaken in collaboration with the US Departments of Education and Justice with the following

objectives in mind: (1) to systematically collect information on all identified school-associated violent deaths, (2) to provide a national estimate of risk for school-associated violent death, (3) to assess national trends in school-

Author Affiliations are listed at the end of this article. **Corresponding Author and Reprints:** Mark Anderson, MD, MPH, Division of Violence Prevention, Centers for Disease Control and Prevention, Mailstop K-60, 4770 Buford Hwy NE, Atlanta, GA 30341 (e-mail: mea6@cdc.gov).

Figure 1. Confirmation of School-Associated Violent Death Events, United States, 1994-1999



associated violent deaths from 1992 through 1999, (4) to identify common features of these events, and (5) to describe potential risk factors for perpetration and victimization.

METHODS

Case Definition

A school-associated violent death was defined as a homicide, suicide, legal intervention (victim killed by police officer in the line of duty), or unintentional firearm-related death in which the fatal injury occurred between July 1, 1994, and June 30, 1999, in one of the following locations: (1) on the campus of a functioning public or private elementary or secondary school in the United States, (2) while the victim was on the way to or from regular sessions at such a school, or (3) while the victim was attending or traveling to or from an official school-sponsored event.¹ Cases included the deaths of both students and nonstudents (faculty, school staff, family members, and community residents).

Case Finding and Confirmation

We identified cases of school-associated violent death using 2 case-finding strategies. The first method involved a systematic search of 2 computerized newspaper and broadcast media databases (Lexis-Nexis and Dialog).^{16,17} The second method, which has been used by

the US Department of Education and the National School Safety Center⁹ since 1992, made use of a newspaper clipping service and voluntary reports from state and local education agencies. The 2 methods generated more than 18000 articles, which were then reviewed. The review identified 424 events with potential cases. After collecting additional media reports on the 424 events, we were able to exclude 179 events because the deaths involved were not associated with a functioning elementary or secondary school in the United States (FIGURE 1).

We then contacted at least 1 law enforcement or school official familiar with each of the remaining 245 events. This process disqualified 25 of the 245 events for various reasons (Figure 1). A total of 220 events involving 253 cases were confirmed.

Data Collection

Once events were confirmed, we obtained data directly from 2 official sources: the police report and/or a structured telephone interview with a police officer who investigated the event, and a structured telephone interview with the school principal or another knowledgeable school official. These sources provided detailed information about the victims and alleged perpetrators, the school associated with each death, and the circumstances of the fatal injuries. For the subset of student victims and perpetrators, these sources provided additional information on the students' criminal, psychological, family, victimization, and school histories.

Several steps were taken to ensure the reliability and validity of the data. First, 2 researchers worked independently and applied preestablished coding criteria to abstract information from police reports, with 93.6% interrater agreement. To avoid data entry errors, the same 2 researchers independently entered coded data from all interviews and reports into 2 separate databases. Finally, using an algorithm to reconcile discrepant responses, we combined the school and police datasets to create a final working dataset. Specifically, for school-related variables, we used responses provided by

school officials over those given by the police. For variables related to criminal or law enforcement issues, we used the police response over the school response. In addition, for variables where both the school and police officials could provide valid information, we used respondents' assessments of their own degree of knowledge of the event to determine which source was likely to be more accurate.

School-level data (eg, urbanicity, school type, and school size) from the US Department of Education's Common Core of Data¹⁸ and Private School Universe Survey¹⁹ were added to the merged dataset.

To facilitate comparisons between perpetrators and victims, we created dichotomous variables for relevant characteristics, with responses separated into "characteristic is present" ("yes" responses) vs "characteristic not known to be present" ("no" or "unknown" responses).

Data Analysis

Rates were calculated to estimate the risk of student school-associated violent death. Denominators for the rate estimates were obtained from the US Department of Education, which provided national school enrollment figures for the 1994-1995 to 1998-1999 academic years broken down by sex, race/ethnicity, grade level, and type of community.^{18,19} We also used mortality data compiled by the National Center for Health Statistics for the period July 1, 1994, through June 30, 1999, to estimate the proportion of violent deaths among all school-aged children (age 5-18 years) that were school associated.²⁰

Trends in school-associated violent death event rates and school-associated student homicide rates were assessed using Poisson regression models with a systematic component incorporating year as a linear term. Because students and nonstudents (faculty, staff, and community members) of all ages died in school-associated violent death events, we calculated event rates using population data from the postcensal annual estimates compiled by the US Census Bureau.²¹

Univariable and bivariable analyses were conducted on event characteristics using the Yates corrected χ^2 test; the 2-tailed Fisher exact test was used when expected values were less than 5. We attempted to identify potential risk factors for homicide perpetration by comparing characteristics of homicide perpetrators to homicide victims, a convenient referent population. These bi-

variable analyses, based on the Wald χ^2 test, were performed in SUDAAN (SUDAAN Statistical Software Center, Research Triangle Park, NC) to adjust for clustering by event. Confidence intervals (CIs) obtained from SUDAAN are reported and used when describing significant differences ($P < .05$).

The study protocol was approved by the institutional review board of the

CDC, Atlanta, Ga. When necessary, we also applied for and received approval from local institutional review boards.

RESULTS

Data from at least 1 official source were obtained for all 220 events. Data from police sources were obtained for 213 (97%) events. We interviewed a school official for 172 (78%) events.

Table 1. Rates of School-Associated Violent Deaths (Students Only), United States, 1994-1999

Variable	Overall*			Homicide			Suicide		
	No. of Deaths	Rate†	Rate Ratio (95% CI)	No. of Deaths	Rate†	Rate Ratio (95% CI)	No. of Deaths	Rate†	Rate Ratio (95% CI)
All student victims	172	0.068	...	146	0.058	...	24	0.010	...
Sex									
Female	52	0.042	1.00	46	0.037	1.00	6	0.005	1.00
Male	120	0.090	2.14 (1.56-2.99)	100	0.075	2.03 (1.43-2.88)	18	0.014	2.80 (1.11-7.07)
Race/ethnicity									
White, non-Hispanic‡	66	0.041	1.00	46	0.028	1.00	19	0.012	1.00
Black, non-Hispanic	59	0.147	3.59 (2.54-5.12)	57	0.141	5.04 (3.39-7.37)	2	0.005	0.42 (0.10-1.82)
Hispanic	37	0.111	2.70 (1.82-4.08)	33	0.099	3.54 (2.23-5.46)	3	0.009	0.75 (0.23-2.60)
Asian/Pacific Islander	6	0.063	1.54 (0.67-3.55)	6	0.062	2.21 (0.94-5.17)	0	0.0	...
School grade§									
Elementary‡	15	0.012	1.00	13	0.010	1.00	1	0.001	1.00
Middle/junior high	26	0.058	4.83 (2.66-9.47)	23	0.051	5.10 (2.59-10.11)	3	0.007	7.00 (0.90-83.45)
Senior high/combined	129	0.166	13.83 (8.43-24.58)	108	0.139	13.90 (7.82-24.73)	8	0.010	10.00 (1.68-107.08)
School district||									
Rural‡	29	0.045	1.00	24	0.037	1.00	4	0.006	1.00
Suburban	63	0.065	1.44 (0.94-2.27)	51	0.053	1.43 (0.88-2.33)	11	0.011	1.83 (0.59-5.82)
Urban	75	0.085	1.88 (1.25-2.94)	66	0.075	2.02 (1.28-3.25)	9	0.010	1.67 (0.51-5.41)

*Overall rates include homicides, suicides, homicide-suicides, legal intervention, and unintentional firearm deaths. CI indicates confidence interval; ellipses, not applicable.

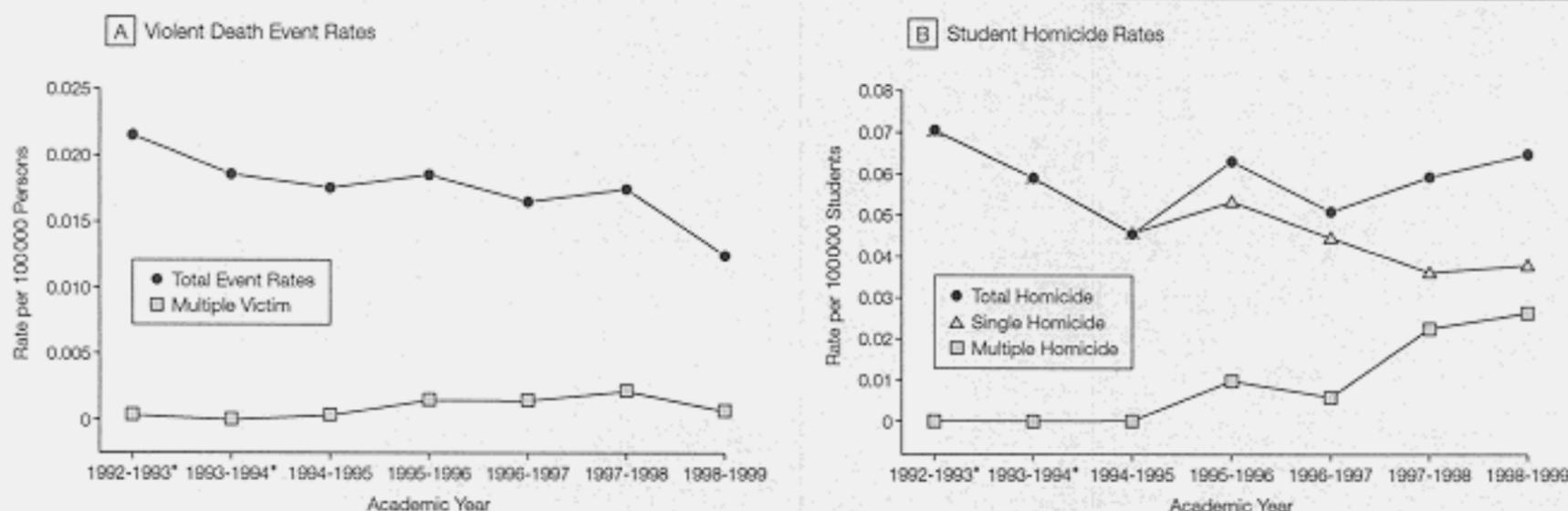
†Per 100 000 students.

‡Referent group.

§Based on National Center for Education Statistics criteria²²: elementary (grades preschool-8), middle/junior high (grades 5-8), high school (grades 9-12), and combined grade school (combination of high school grades and lower grades).

||Based on locale codes in Department of Education's Common Core of Data¹⁶: urban (a large or midsize city), suburban (urban fringe of a large or midsize city), and rural (large town, small town, and rural).

Figure 2. Total School-Associated Violent Death Event Rates vs Multiple-Victim Homicide Event Rates and Student Homicide Rates by Academic Year, United States, 1992-1999



Rates marked with asterisk based on data from Kachur et al.¹ There were no multiple-victim student homicides for the school years 1992-1993, 1993-1994, and 1994-1995.

Of the 220 school-associated violent death events, 202 involved the death of 1 victim, while 18 events involved the deaths of multiple victims (median=2 victims per multiple-victim event). Overall, 131 events involved 1 perpetrator and 76 involved more than 1 perpetrator; for 13 events, the number of perpetrators was unknown.

In total, 253 victims died in 220 school-associated violent death events. Of these victims, 172 (68.0%) were students, 18 (7.1%) were faculty/staff, 12 (4.7%) were family members of students, 30 (11.9%) were residents of the surrounding community, 4 (1.6%) were associated with the school in other ways, 12 (4.7%) were not directly associated with the school or surrounding community, and 2 (0.8%) were police officers; school association was unknown for 3 (1.2%) victims. Among the 279 known perpetrators, 103 (36.9%) were students, 2 (0.7%) were faculty/staff, 7 (2.5%) were family members of a student, 72 (25.8%) were residents of the surrounding community, 50 (17.9%) were not directly associated with the school or surrounding community, and 5 (1.8%) were associated with the school in other ways; school association was unknown or missing for 35 (12.5%) perpetrators. The actions of 5 police officers in the line of duty led to a school-associated violent death.

Student Risk Estimates

The average annual rate of school-associated violent death for students was 0.068 per 100 000 students (TABLE 1). The rate of school-associated violent death for male students was more than twice as high as the rate for female students. The rate for non-Hispanic, black students was more than 3 times higher than the rate for non-Hispanic, white students. Students in senior high schools (grades 9-12) or combined grade schools (schools that combined high school grades with lower grades) had a school-associated violent death rate that was nearly 14 times higher than students in elementary schools (preschool-grade 8). Students in urban school districts experienced a rate of school-associated vio-

lent death (0.085 per 100 000 students) almost twice as high as students in rural areas (0.045 per 100 000 students).

The pattern for homicides was consistent with this overall pattern; for suicides, the rates were higher, although not

Table 2. Characteristics of All School-Associated Violent Death Events, United States, 1994-1999*

	Total, No. (%) (N = 220)	Homicide, No. (%) (n = 172)	Suicide, No. (%) (n = 30)
Type of fatality			
Homicide	172 (78.2)	...	...
Suicide	30 (13.6)	...	...
Homicide-suicide	11 (5.0)	...	...
Legal intervention	5 (2.3)	...	...
Unintentional	2 (0.9)	...	...
Type of school†			
Elementary school	41 (18.6)	32 (18.8)	2 (6.7)
Middle/junior high school	34 (15.5)	29 (17.1)	4 (13.3)
High school/combined	143 (65.0)	109 (64.1)	24 (80.0)
School size			
Small (≤299 students)	14 (6.5)	11 (6.6)	2 (6.7)
Medium (300-999 students)	91 (42.3)	70 (41.9)	11 (36.7)
Large (≥1000 students)	110 (51.2)	86 (51.5)	17 (56.7)
Urbanicity of the community			
Urban	112 (52.3)	96 (57.8)	11 (36.7)‡
Suburban	74 (34.6)	50 (30.1)	14 (46.7)
Rural	28 (13.1)	20 (12.0)	5 (16.7)
Location of event			
On campus	147 (66.8)	106 (61.6)	27 (90.0)‡
Classroom	11 (5.0)	8 (4.7)	3 (10.0)
Hallway	13 (5.9)	11 (6.4)	2 (6.7)
Restroom	8 (3.6)	1 (0.6)	6 (20.0)§
Other indoor location	16 (7.3)	12 (7.0)	1 (3.3)
Parking area	38 (17.3)	29 (16.9)	3 (10.0)
Sporting fields/playground	24 (10.9)	15 (8.7)	7 (23.3)
Other outdoor location	37 (16.8)	30 (17.4)	5 (16.7)
Off campus	73 (33.2)	66 (38.4)	3 (10.0)§
Streets/sidewalk	48 (21.8)	45 (26.2)	0 (0.0)§
In vehicle	10 (4.5)	7 (4.1)	2 (6.7)
Waiting for vehicle	3 (1.4)	3 (1.7)	0 (0.0)
Private property	4 (1.8)	3 (1.7)	1 (3.3)
Other off-campus location	8 (3.6)	8 (4.7)	0 (0.0)
Time of fatal injury			
During school activities	110 (50.0)	89 (51.7)	16 (53.3)
Classes	42 (19.1)	35 (20.3)	4 (13.3)
Break period	16 (7.3)	10 (5.8)	6 (20.0)
After school activities	52 (23.6)	44 (25.6)	6 (20.0)
Before or after official activities	71 (32.3)	51 (29.7)	12 (40.0)
Day with no classes or activities	22 (10.0)	17 (9.9)	2 (6.7)
Unknown or other	17 (7.7)	15 (8.7)	0 (0.0)
Method of injury			
Firearm	164 (74.5)	119 (69.2)	27 (90.0)‡
Handgun	123 (55.9)	89 (51.7)	21 (70.0)
Long gun	29 (13.2)	18 (10.5)	6 (20.0)
Unknown type	12 (5.5)	12 (7.0)	0 (0.0)
Knife or other blade	31 (14.1)	31 (18.0)	0 (0.0)§
Beaten	12 (5.5)	12 (7.0)	0 (0.0)
Hanging/strangulation	7 (3.2)	5 (2.9)	2 (6.7)
Other	6 (2.7)	5 (2.9)	1 (3.3)

(continued)

significantly, among whites and in suburban areas.

Between July 1, 1994, and June 30, 1999, 20541 school-aged children (5-18 years) died as result of homicide

(n=12376) or suicide (n=8165) in the United States.²⁰ During the same time period, 155 homicides and 28 suicides that were associated with a school occurred among children 5 to 18 years of age (in-

cludes homicides and suicides associated with a homicide-suicide event). Thus, 0.9% of homicides and suicides among school-aged children were school associated (1.3% of all homicides and 0.3% of all suicides).

Table 2. Characteristics of All Events, United States, 1994-1999* (cont)

	Total, No. (%) (N = 220)	Homicide, No. (%) (n = 172)	Suicide, No. (%) (n = 30)
Motive||			
Any interpersonal dispute	102 (46.4)	82 (47.7)	9 (30.0)
Dispute over romantic relationship	33 (15.0)	22 (12.8)	6 (20.0)
Dispute over money or property	10 (4.5)	8 (4.7)	...
Dispute related to sporting event	6 (2.7)	6 (3.5)	...
Other interpersonal dispute	61 (27.7)	53 (30.8)	4 (13.3)
Gang-related	52 (23.6)	51 (29.7)	...
No identifiable motive	23 (10.5)	21 (12.2)	...
Robbery or attempted robbery	17 (7.7)	17 (9.9)	...
Rape, attempted sex crime	9 (4.1)	9 (5.2)	...
Drug-related activities	8 (3.6)	7 (4.1)	1 (3.3)
Racially or hate crime motivated	5 (2.3)	5 (2.9)	...
Victim killed by police/security	5 (2.3)	...	...
Victim killed by civilian during commission of crime	4 (1.8)	4 (2.3)	...
Notes, threats, or other actions prior to event||§			
Notes	35 (15.9)	13 (7.6)	17 (56.7)†
Threats	75 (34.1)	50 (29.1)	17 (56.7)†
Journal entries	10 (4.5)	4 (2.3)	4 (13.3)§
Arguments	16 (7.3)	14 (8.1)	1 (3.3)
Fights	15 (6.8)	14 (8.1)	0 (0.0)
Other actions#	60 (27.3)	63 (36.6)	21 (70.0)†
Any note, threat, journal entry, or other action	120 (54.5)	84 (48.8)	25 (83.3)†

*Some data were missing or unknown for some events. Ellipses indicate not applicable.

†Based on National Center for Education Statistics criteria²²: elementary (grades preschool-8), middle/junior high (grades 5-8), high school (grades 9-12), and combined grade school (combination of high school grades and lower grades).

‡P<.05 by Yates corrected χ^2 test for homicide vs suicide.

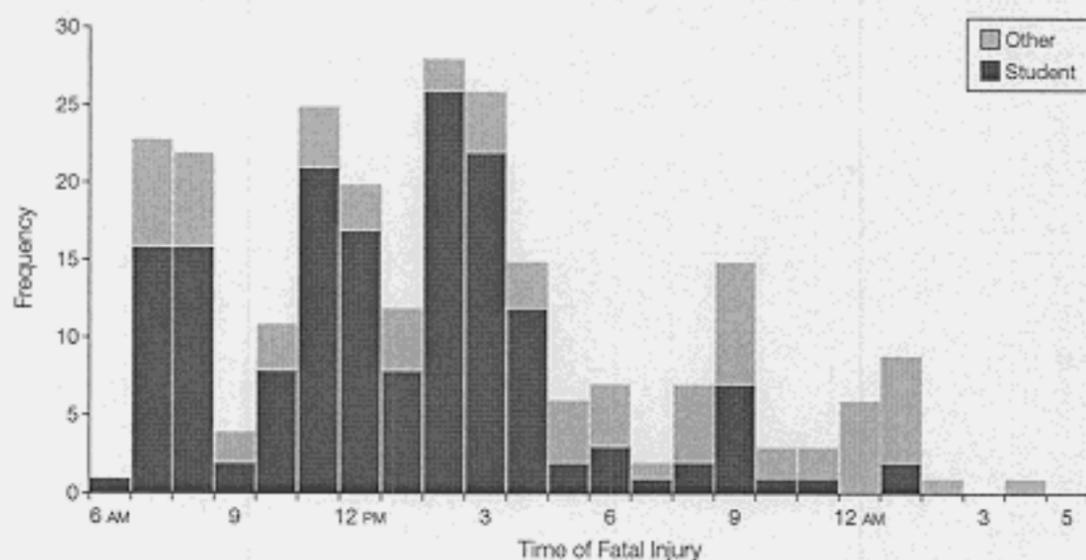
§P<.05 by Fisher exact test for homicide vs suicide.

||More than 1 may apply.

¶May include actions not known at the time of the event.

#Includes gang activity, criminal activity, weapon seeking, harassment, stalking, planning, school problems, and giving property away.

Figure 3. School-Associated Violent Deaths by Time of Fatal Injury, United States, 1994-1999



Trends

We included data from the previous CDC study¹ on school-associated violent deaths to examine trends in these events for the academic years 1992-1993 through 1998-1999 (FIGURE 2A). The rate of school-associated violent death events has decreased significantly since the 1992-1993 school year ($P=.03$). However, during the same period, the rate of events in which more than 1 victim was killed due to homicide increased significantly ($P=.047$).

We also examined trends in student homicide rates by year (Figure 2B). The death rate for single-victim student homicides declined between 1992 and 1999 ($P=.007$). The rate for multiple-victim student homicides has increased since the 1994-1995 school year ($P<.001$). Consequently, total homicide rates for students killed in school-associated violent death events have increased in recent years.

Features of School-Associated Violent Death Events

Of the 220 school-associated violent death events, 172 were homicides, 30 were suicides, 11 were homicide-suicides, 5 were legal intervention deaths, and 2 were unintentional firearm-related deaths (TABLE 2).

Fifty percent of all school-associated death events ($n=110$) occurred while official school activities were in progress, most often during classes ($n=42$ [19.1%]) or after school activities ($n=52$ [23.6%]). When examined by the hour in which the fatal injury occurred (FIGURE 3), 17.8% ($n=45$) of the 253 school-associated violent deaths occurred near the start of school (7-9AM), 17.8% ($n=45$) during the lunchtime hours (11AM-1PM), and 21.3% ($n=54$) near the end of the school day (2-4PM).

We also sought to understand how often homicide perpetrators' or suicide vic-

tims' actions (eg, threats, notes, journal entries) prior to the incident may have indicated a potential risk for this type of behavior. We asked police and school officials to be as inclusive as possible when listing the potential signs that were made and to include actions that others may not have recognized as a sign at the time they happened. Over half of the events (n=120 [54.5%]) were preceded by some action that indicated potential for the coming event. When we compared the characteristics of suicide and homicide events, we found that, overall, signifi-

cantly more suicide events were preceded by a potential signal.

A significantly greater share of homicide events than suicide events occurred in urban areas (57.8% vs 36.7%) and at off-campus locations (38.4% vs 10.0%). Suicide events more frequently involved the use of a firearm (90.0% vs 69.2%).

Features of Homicide Perpetrators and Homicide Victims

Within the total population of all perpetrators and all victims, homicide per-

petrators were far more likely than homicide victims to have expressed suicidal behaviors such as suicidal thoughts, plans, or actual attempts before the event (odds ratio [OR], 6.96; 95% CI, 1.96-24.65) (TABLE 3). Overall, homicide perpetrators were also more likely than homicide victims to have had a history of criminal charges (OR, 6.12; 95% CI, 3.81-9.82), been a gang member (OR, 4.96; 95% CI, 3.18-7.74), have associated with high-risk peers or be considered a loner (OR, 6.22; 95% CI, 4.02-9.61), or used alcohol or drugs on a

Table 3. Homicide Perpetrators Compared With Homicide Victims, United States, 1994-1999*

Variable	Students			Nonstudents		
	Homicide Perpetrator, No. (%) [†] (n = 102)	Homicide Victim, No. (%) [‡] (n = 137)	Odds Ratio (95% CI)||	Homicide Perpetrator, No. (%) [†] (n = 157)	Homicide Victim, No. (%) [‡] (n = 64)	Odds Ratio (95% CI)||
Demographic characteristics						
Median age (range), y	16 (9-19)	16 (5-20)	...	19 (13 to ≥66)	29.5 (<5 to ≥66)	...
Age <20 y	101 (100.0)	135 (99.3)	Undefined	81 (54.7)	19 (29.7)	2.86 (1.43-5.74)
Male	95 (93.1)	93 (67.9)	6.42 (2.94-14.01)	148 (96.7)	45 (70.3)	12.50 (4.63-33.72)
Race/ethnicity						
White, non-Hispanic	30 (29.7)	45 (32.3)	0.86 (0.52-1.43)	20 (13.3)	27 (42.2)	0.21 (0.11-0.40)
Black, non-Hispanic	44 (43.6)	52 (38.0)	1.26 (0.80-2.00)	80 (53.0)	27 (42.2)	1.54 (0.88-2.72)
Hispanic	18 (17.8)	32 (23.4)	0.71 (0.38-1.34)	40 (26.7)	8 (12.5)	2.55 (1.08-5.98)
2-Parent family structure	38 (40.4)	53 (47.3)	0.76 (0.42-1.36)	23 (21.1)	24 (47.0)	0.30 (0.13-0.70)
Student at time of death	...	...	...	...	...	...
Psychosocial characteristics						
History of criminal charges	47 (46.1)	22 (16.1)	4.47 (2.21-9.05)	105 (68.2)	16 (26.7)	5.89 (2.89-12.00)
Gang member	40 (39.2)	20 (14.6)	3.77 (2.04-6.99)	79 (51.6)	10 (15.9)	5.66 (2.42-13.21)
High-risk peer association/loner	71 (69.6)	38 (27.7)	5.97 (3.22-11.07)	101 (66.0)	12 (19.1)	8.26 (3.80-17.96)
Weekly alcohol or drug use	22 (21.6)	13 (9.5)	2.62 (1.30-5.28)	57 (37.0)	10 (16.7)	2.94 (1.35-6.39)
Intoxicated at time of event	4 (3.9)	5 (3.7)	1.08 (0.32-3.62)	31 (20.1)	10 (16.7)	1.26 (0.53-3.02)
Any suicidal behavior prior to event [¶]	12 (11.7)	2 (1.5)	9.00 (2.67-30.34)	5 (3.3)	0 (0.0)	Undefined [#]
Extracurricular activities ^{**}	15 (15.2)	56 (40.9)	0.26 (0.13-0.50)	...	...	...
Received psychological counseling ^{**}	15 (14.7)	7 (5.1)	3.20 (1.28-8.00)	...	...	...
Treated for depression ^{**}	5 (4.9)	2 (1.5)	3.48 (0.62-19.51)	...	...	...
Any cognitive disability ^{**}	24 (24.2)	20 (14.6)	1.87 (0.99-3.53)	...	...	...
Documented family problems ^{**}	13 (12.9)	16 (11.7)	1.12 (0.60-2.06)	...	...	...
Reported for disobedience ^{**}	29 (28.7)	19 (13.9)	2.50 (1.35-4.62)	...	...	...
Reported for fighting peers ^{**}	37 (36.6)	23 (16.8)	2.87 (1.42-5.78)	...	...	...
Bullied by peers ^{**}	20 (19.8)	12 (8.8)	2.57 (1.12-5.92)	...	...	...
Experienced romantic breakup ^{**}	10 (9.9)	8 (5.8)	1.77 (0.76-4.12)	...	...	...

*Some data were missing or unknown for some subjects. Ellipses indicate not applicable; CI, confidence interval.

[†]Some events involved multiple perpetrators.

[‡]Perpetrators who committed a homicide and then killed themselves as part of a homicide-suicide event were included in analyses of homicide perpetrators.

[§]Referent group.

^{||}Cross tabulations performed in SUDAAN to adjust for clustering by event. CI indicates confidence interval.

[¶]Excluding homicide-suicide perpetrators from the analyses related to suicidal behavior did not effect the relationship presented.

[#]P<.05 by Wald χ^2 test.

^{**}Asked of students only.

our study, perpetrators were more likely than victims to have been described as having been bullied by their peers. These bullied youth may represent the "provocative" or "aggressive" victims described in recent studies on bullying behavior, who often retaliate in an aggressive manner in response to being bullied.²⁵⁻²⁸ This group represents a particularly high-risk population. Data from a nationally representative sample indicate that 16.9% of students have been bullied on more than 1 occasion.²⁹ Combined with our findings, these data demonstrate the importance of programs designed to help teachers and other school staff recognize and respond to incidents of bullying between students.

Finally, the results presented in this study emphasize the need for routine surveillance of school-associated violent death events. Efforts should be made to make these events reportable to statewide public health, education, and criminal justice agencies. With complete surveillance information on school-associated violent deaths, we can address public concerns and develop prevention strategies more effectively.

Because these data are based on a small number of deaths, some of the risk estimates presented may be unstable and should be viewed with caution. In addition, the data described are from secondary sources and are subject to error and bias. The high visibility and traumatic nature of these events may differentially affect how respondents recall the characteristics of victims and perpetrators. For instance, victims may have been viewed in a more positive light than perpetrators, and this may have influenced the responses.

In summary, this study provides data from a systematic examination of all known school-associated violent deaths from 1994 to 1999. In thinking about the prevention of school-associated violent deaths, it is important to remember that they are rare but complex events. There are no simple solutions; violence prevention efforts are needed to address risks to young people at school, at home, and in their communities. By describing the features of these events and comparing

homicide perpetrators to homicide victims, this study provides some directions for responding to the problem of school-associated violent deaths now and preventing more deaths in the future.

Author Affiliations: Division of Violence Prevention (Drs Anderson, Simon, Paulozzi, and Hammond) and Office of Statistics and Programming (Dr Ryan), National Center for Injury Prevention and Control, and Division of Adolescent and School Health, National Center for Chronic Disease Prevention and Health Promotion (Dr Barrios), Centers for Disease Control and Prevention, Atlanta, Ga; Department of Sociology, University of Miami, Coral Gables, Fla (Dr Kaufman); Safe and Drug Free Schools Program, US Department of Education, Washington, DC (Mr Modzeleski); National Institute of Justice, US Department of Justice, Washington, DC (Dr Feucht); and Education Development Center, Inc, Newton, Mass (Dr Potter).

Author Contributions: Study concept and design: Anderson, Kaufman, Simon, Reza, Barrios, Modzeleski, Potter.

Acquisition of data: Anderson, Kaufman, School-Associated Violent Deaths Study Group.

Analysis and interpretation of data: Anderson, Kaufman, Ryan, Simon. **Drafting of the manuscript:** Anderson, Kaufman, Simon.

Critical Revision of the manuscript for important intellectual content: Anderson, Barrios, Feucht, Hammond, Kaufman, Modzeleski, Paulozzi, Potter, Ryan, Simon, School-Associated Violent Deaths Study Group. **Statistical expertise:** Kaufman, Ryan, Kegler.

Administrative, technical, or material support: Anderson, Barrios, Feucht, Kaufman, Modzeleski, Paulozzi, Potter, Ryan, Simon, School-Associated Violent Deaths Study Group.

Study supervision: Anderson, Kaufman.

The School-Associated Violent Deaths Study Group includes Bernadette Ford Lattimore, MPH, Ezra Jones, MPH, LaMar Hasbrouck, MD, MPH, Scott Kegler, PhD, Avid Reza, MPH, and Anita Teague Ruff, MPH.

Acknowledgment: The authors are grateful to the many local police and school officials who participated in the study. We especially acknowledge Linda Dahlberg, PhD, James Mercy, PhD, and Kenneth Powell, MD, MPH, for their scientific guidance and critical reviews of the manuscript, and Katherine Cheairs for her critical assistance with data collection. We thank Joanna Taliano and Sandy Bonzo for their assistance with newspaper and broadcast media databases searches. In addition, we thank Sharon Arscott-Mills, MPH, Zoanne Clack, MD, MPH, Cynthia Collins, MPA, Elizabeth Crane, PhD, MPH, Alex Crosby, MD, MPH, Sujata Desai, PhD, Cliff Dunaway, Tonji Durant, PhD, Bart Hammig, PhD, MPH, Debra Hayes-Hughes, MS, Scott Kegler, PhD, Etienne Krug, MD, MPH, Marcella Law, MPH, Kerri Lubell, PhD, Gail McMahon, RN, Roberto Hugh Potter, PhD, Clara Ruiz, RN, Raul Ruiz, MD, Monica Swahn, PhD, MPH, Tim Thornton, MPA, and Wendy Watkins for their assistance with various aspects of the study.

REFERENCES

1. Kachur SP, Stennies G, Powell K, et al. School-associated violent deaths in the United States, 1992 to 1994. *JAMA*. 1996;275:1729-1733.
2. Adams J. Three students killed, 5 wounded in shooting. *The Courier-Journal*. December 2, 1997:01A.
3. Associated Press. One slain, 5 critical at Oregon high school—police find two more dead at home of shooter. *Seattle Times*. May 21, 1998:A1.
4. Beason T, Williams M, Norton D, Beers C. Student opens fire, kills 3—2 classmates, teacher slain at

junior high in Moses Lake. *Seattle Times*. February 3, 1996:A1.

5. Edsall TB. Mississippi boy held in school killing spree; teenager is also accused in mother's stabbing death. *The Washington Post*. October 2, 1997:A03.

6. Obmascik M. High school massacre bloodbath leaves up to 25 dead. *Denver Post*. April 21, 1999:A-01.

7. Schwarz J. Boy's ambush at Ark school leaves 5 dead: suspects are 11 and 13; 11 wounded in rampage. *The Washington Post*. March 25, 1998:A01.

8. Wire Services. Teacher shot dead at 8th-grade dance. *Pittsburgh Post-Gazette*. April 25, 1998:A-1.

9. *School Associated Violent Deaths*. Westlake Village, Calif: National School Safety Center; 2001.

10. McGee J, DeBernardo C. The classroom avenger. *The Forensic Examiner*. 1999;8:16-18.

11. Band S, Harpol J. School violence: lessons learned. *FBI Law Enforcement Bull*. 1999;68:9-16.

12. Vossekuil B, Reddy M, Fein R. *Safe School Initiative: An Interim Report on the Prevention of Targeted Violence in Schools*. Washington, DC: US Secret Service, National Threat Assessment Center; 2000.

13. O'Toole M. *The School Shooter: A Threat Assessment Perspective*. Quantico, Va: Critical Incident Response Group, FBI Academy, National Center for the Analysis of Violent Crime; 2000.

14. Danner MJE, Carmody DC. Missing gender in cases of infamous school violence: investigating research and media explanations. *Justice Q*. 2001;18:87-114.

15. Meloy JR, Hempel AG, Mohandie K, Shiva AA, Gray BT. Offender and offense characteristics of a non-random sample of adolescent mass murderers. *J Am Acad Child Adolesc Psychiatry*. 2001;40:719-728.

16. Lexis-Nexis [database online]. Dayton, Ohio: Lexis-Nexis; 2001.

17. Dialog [database online]. Cary, NC: The Dialog Corporation; 2001.

18. National Center of Education Statistics, US Department of Education. Common Core of Data, 1994-1999. Available at: <http://nces.ed.gov/ccd/>. Accessibility verified October 24, 2001.

19. *Private School Universe Survey*. Washington, DC: National Center of Education Statistics, US Dept of Education; 1995-1998.

20. *Unpublished Data From the National Center for Health Statistics Vital Statistics System, 1994-1999*. Atlanta, Ga: National Center for Injury Prevention and Control, Office of Statistics and Programming, Centers for Disease Control and Prevention; 2001.

21. *Resident Population Estimates of the United States*. Washington, DC: Population Estimates Program, Population Division, US Census Bureau; 1992-1999.

22. Kaufman P, Chen X, Choy SP, et al. *Indicators of School Crime and Safety, 2000*. Washington, DC: US Depts of Education and Justice; 2000.

23. Dwyer K, Osher D. *Safeguarding Our Children: An Action Guide*. Washington, DC: US Depts of Education and Justice, American Institutes for Research; 2000.

24. Brener ND, Simon TR, Krug EG, Lowry R. Recent trends in violence-related behaviors among high school students in the United States. *JAMA*. 1999;282:440-446.

25. Olweus D. *Aggression in the Schools: Bullies and Whipping Boys*. Washington, DC: Hemisphere Publishing; 1978.

26. Olweus D. Bullying at school: basic facts and effects of a school based intervention program. *J Child Psychol Psychiatry*. 1994;35:1171-1190.

27. Pellegrini AD. Bullies and victims in school: a review and call for research. *J Appl Dev Psychol*. 1998;19:165-176.

28. Pellegrini AD, Bartini M, Brooks F. School bullies, victims, and aggressive victims: factors relating to group affiliation and victimization in early adolescence. *J Educ Psychol*. 1999;91:216-224.

29. Nansel TR, Overpeck M, Pilla RS, Ruan WJ, Simons-Morton B, Scheidt P. Bullying behaviors among US youth: prevalence and association with psychosocial adjustment. *JAMA*. 2001;285:2094-2100.