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Adolescent and Young Adult Suicide: A 10-Year Retrospective Review of Kentucky Medical Examiner Cases

ABSTRACT: The compilation of all suicidal causes of death attained the third highest ranking of mortality between the ages of 15 and 24 following unintentional deaths and homicide in the United States, accounting for approximately 4000 deaths in 2002. A variety of biopsychosocial factors may contribute to adolescent suicidal behavior, including psychiatric disorders, risk-taking behaviors, and lack of a cohesive family unit. The authors conducted a 10-year (1993–2002) retrospective review of 108 Medical Examiner cases of suicide ages 11–17 and 358 cases ages 18–24 in Kentucky, which represents two thirds of the Coroner cases in the state. The majority of victims were male and Caucasian. The major causes of death were the same for the two age groups, specifically, firearm injury (72.2% and 70.7%), hanging (22.2% and 18.7%), and drug intoxication (2.8% and 5.3%). An integrated Coroner-Medical Examiner system profits in the public health arena by providing collaborative research data for policy decisions. The prevalence of youth suicide by firearm should prompt further discussion regarding ways to better identify high-risk adolescents and young adults and restrict pediatric access to unsecured household firearms.

KEYWORDS: forensic science, forensic pathology, suicide, adolescent, youth, firearms

As children advance into adolescence, many experience a tumultuous period of maturation, characterized by efforts to gain independence and transition into adult society. This period of exploration and transformation is often associated with varying levels of anxiety and stress, which may lead to maladaptive feelings of hopelessness, personal failure, and suicidal ideation. The estimated ratio of attempted suicides to completed suicides among adolescents is 200:1 (1) which is significantly higher than that of the general population in which there are an estimated 10–25 attempts for every completed suicide (2).

The death investigation of an adolescent or young adult suicide relies on elucidating the interaction of three primary factors: (1) the victim's psychopathology such as depression, personality disorders, or substance abuse; (2) the social environment, particularly the deceased's family dynamics; and (3) life stressors that may have prompted suicidal behavior (3–5). The majority of adolescent suicides suffer from either single or combined psychiatric disorders. The most common expressions of maladaptive behaviors include affective and personality disorders, substance abuse, anxiety or conduct disorders, eating disorders, and aggressive and antisocial tendencies (3,6–11). Youths often engage in risk-taking behaviors. Prominent among these are inattentive motor vehicular operation, lack of auto seatbelt use, consuming ethanol or using marijuana, riding with a driver under the influence of ethanol, running away from home, truancy, weapon carrying, auto theft, and

assault (12,13). The lack of a cohesive family unit may provoke suicidal ideation. Specific manifestations of familial dysfunction include poor parent–child communication, loss of a primary caregiver, parental violence, psychopathological disorders, or legal difficulties (14,15). Most commonly associated with youths between 15 and 24, cluster suicides refer to “higher-than-expected numbers of suicides occurring in a small geographic area within a limited time period” (16). Cluster suicides may be precipitated by either the suicide of a member of the individual's peer group or media exposure, encouraging the youth to imitate suicidal behavior (11).

This 10-year (1993–2002) study summarizes the features discerned through medical examiner autopsies, toxicological analyses, and coroners' investigations of adolescent and young adult suicide in Kentucky. As Kentucky is a dual Coroner-Medical Examiner system, the Coroner bears the responsibility of determining whether an autopsy should be performed in a particular death. In this respect, two-thirds of the Coroner cases of suicide were referred to the Medical Examiner's office for a postmortem examination. This study analyzes the similarities and differences in suicidal outcomes between the adolescent group (ages 11–17) and young adult group (ages 18–24).

Materials and Methods

We conducted a 10-year (1993–2002) retrospective review of suicides ages 11–24 at the Medical Examiners' Offices in Kentucky. A Coroner-Medical Examiner's system is in place in Kentucky and, therefore, a request for a medicolegal postmortem examination rests on the discretion of the coroner in the county of death. The present study focused on the Medical Examiners' cases of suicide. The age, race, and sex of each victim as well as cause of death and time of year were recorded. Each chart was evaluated for the location of pronouncement of death, presence of a suicide note, history of suicide attempts, and recent life stressors such as domestic turmoil and legal difficulties. The investigation included analysis of postmortem toxicological findings.

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Toxicological analyses of the Medical Examiners' cases were performed on blood, urine, or other matrices as indicated by case specifics. The screening covered ethanol and other volatiles as well as a multitude of prescription, over-the-counter, and illicit drugs. Extraction techniques included both liquid-liquid and solid phase extractions. Preliminary screening was by thin layer chromatography, gas chromatography (GC), and immunoassays with confirmation and quantitation by GC or gas chromatography-mass spectroscopy. Ethanol and other volatiles were screened by dual column headspace GC. Immunoassay confirmed the presence of ethanol. Carbon monoxide was analyzed spectrophotometrically.

Results

Demographics

A total of 2864 cases from all 120 Kentucky counties were classified as suicidal manner after a thorough postmortem examination at the Medical Examiners' offices between 1993 and 2002 (17). The 466 (16.3%) suicides ages 11–24, were further subdivided into 108 victims ages 11–17 and 358 victims ages 18–24. The race and sex of the victims are displayed in Table 1. The majority of victims in both groups were males (88.9% and 87.4%) and Caucasian (88% and 90.8%). Very few African American females committed suicide, consisting of only 0.92% and 0.84% of victims in each group, respectively. The month of the year of suicide varied between the two age groups (Table 2). Suicide peaked in September for the group ages 11–17, most likely attributable to the academic and social tensions associated with the start of the school year. The highest percentage of cases for the group ages 18–24 occurred in January.

Location of Pronouncement of Death and Performance of Autopsy

The percentages of victims who were pronounced dead at specific locations were similar for both age groups. A majority of persons were pronounced dead at a residential home (56.5% and 53.9%), while the others were pronounced dead at one of the following locations: hospital (32.4% and 29.6%), public location (7.4% and 13.4%), motel (0% and 1.1%), prison (0.92% and 0.84%), and unknown (2.8% and 0.84%). Of the Medical Examiners' cases, a complete postmortem examination was performed on 84 (77.8%) victims in the age group 11–17 and on 286 (79.9%) victims in the older age group. The remainder of the victims underwent a limited autopsy, such as in certain cases of a firearm injury of the head, which consisted of a limited external, cranial,

TABLE 2—Suicides ages 11–24 examined in Kentucky Medical Examiners' Offices, 1993–2002, by month.

Month	Number (%) of victims	
	Ages 11–17	Ages 18–24
January	9 (8.3)	40 (11.2)
February	11 (10.2)	27 (7.5)
March	5 (4.6)	35 (9.8)
April	10 (9.2)	28 (7.8)
May	11 (10.2)	22 (6.1)
June	9 (8.3)	23 (6.4)
July	6 (5.6)	33 (9.2)
August	11 (10.2)	34 (9.5)
September	14 (13.0)	37 (10.3)
October	6 (5.6)	19 (5.3)
November	8 (7.4)	30 (8.4)
December	8 (7.4)	30 (8.4)

and toxicological examination. In other cases, the descendants underwent organ procurement for donation before the autopsy.

Method of Suicide

Firearm injury was by far the most common method of suicide for the two age groups, accounting for 78 (72.2%) deaths for ages 11–17 and 253 (70.7%) fatalities for ages 18–24. The proximate causes of death are tabulated in Table 3. Single gunshot wounds of the head were most common among subjects in both age groups. Only one individual in our study succumbed to multiple cephalic gunshot wounds. In this case, a 21-year-old Caucasian male inflicted two entrance wounds to the submental region. He had written a suicide note, lamenting over turmoil with his girlfriend.

In another case, a 23-year-old Caucasian male sustained fatal self-inflicted sharp force injuries to the trunk with perforations of the heart and right lung. He had professed suicidal ideation before his demise although had not attempted suicide previously. The subject stabbed himself utilizing a knife while arguing with his girlfriend in his car. Table 4 depicts the most common causes of death in relation to the sex of the victims. Firearm injury of the head constituted the leading cause of death in both sexes and in both age groups.

Postmortem Toxicological Analysis

Whole blood was collected in 102 (94.4%) cases and urine in 81 (75.0%) cases in the suicide group ages 11–17 (Table 5). Whole

TABLE 1—Suicides ages 11–24 examined in Kentucky Medical Examiners' Offices, 1993–2002, by race and sex.

Race	Males	Females
Caucasian		
95 victims (88%)	84 (77.8%)	11 (10.2%)
325 victims (90.8%)	285 (79.6%)	40 (11.2%)
African American		
13 victims (12%)	12 (11.1%)	1 (0.92%)
27 victims (7.5%)	24 (6.7%)	3 (0.84%)
Other		
0 victims	0	0
6 victims (1.7%)	4 (1.1%)	2 (0.56%)
Total: 466 victims		
108 victims	96 (88.9%)	12 (11.1%)
358 victims	313 (87.4%)	45 (12.6%)

Italicized data in this table represent victims comprising suicide group ages 11–17; non-italicized data in this table reflect victims comprising suicide group ages 18–24.

TABLE 3—Suicides ages 11–24 examined in Kentucky Medical Examiners' Offices, 1993–2002, by cause of death.

Cause of death	Number of cases	
	Ages 11–17	Ages 18–24
Firearm injury	78 (72.2%)	253 (70.7%)
Directed at head	74 (94.9%)	216 (85.4%)
Hanging	24 (22.2%)	67 (18.7%)
Overdose	3 (2.8%)	19 (5.3%)
Carbon monoxide intoxication	0	12 (3.4%)
Blunt force injury	2 (1.8%)*	5 (1.4%)†
Drowning‡	1 (0.92%)	1 (0.28%)
Stabbing	0	1 (0.28%)

*Includes one case of impact by train and one case of pedestrian in traffic.

†Includes four cases of fall from a height and one case of pedestrian in traffic.

‡Indicates drowning after a fall from a height.

TABLE 4—Gender in relation to leading causes of suicidal death ages 11–24 examined in Kentucky Medical Examiners' Offices, 1993–2002.

Ages 11–17 (n = 108)	Males: n = 96	Females: n = 12
	FI: 70 (73%)	FI: 8 (67%)
	Head: 67 (96%)	Head: 7 (88%)
	Hanging: 23 (24%)	Overdose: 2 (17%)
Ages 18–24 (n = 358)	Males: n = 313	Females: n = 45
	FI: 224 (72%)	FI: 29 (64%)
	Head: 193 (86%)	Head: 23 (79%)
	Hanging: 58 (18%)	Hanging: 9 (20%)
	Overdose: 12 (3.8%)	Overdose: 7 (15.6%)
	CO intoxication: 12 (3.8%)	

FI = Firearm injury.

blood was retrieved in 337 (94.1%) cases and urine in 263 (73.5%) subjects ages 18–24. Blood toxicology was negative in 64 (62.7%) victims of the younger group and in 136 (40.3%) of the older group. Urine toxicology screens yielded no drugs in 58 (71.6%) and 145 (55.1%) of victims in each group, respectively. The blood alcohol concentration (BAC) was negative in 85 (83.3%) victims ages 11–17 and in 199 (59.1%) victims ages 18–24. In a minority of adolescents and young adults, psychoactive medications were detected in the postmortem blood, specifically, benzodiazepines, antidepressants, and opiates. Three other classes of prescription medications were present in the postmortem blood in both groups, including antipsychotics (2.0% and 0.3%), amphetamines (0.98% and 0.89%), and barbiturates (0% and 0.89%). A category labeled “Mixed drugs” included a variety of 27 additional substances detected in the blood, including diphenhydramine, dextromethorphan, and acetaminophen. A total of 13 (12.7%) suicide victims in the younger group and 56 (15.6%) subjects in the older group had at least one of the drugs listed as “Mixed drugs” present in their blood at autopsy.

Suicidal Ideation, Suicide Attempts, and Suicide Notes

The postmortem examination in combination with the Coroners' investigation of the suicidal deaths of the adolescents and young adults in this study disclosed specific indices that may have contributed to the youth's demise. Ten (9.2%) individuals ages 11–17 had previously attempted suicide, in most cases, by incised wounds of the upper extremities; 60% of these victims succumbed to a cranial firearm wound. Of the 35 (9.8%) victims ages 18–24 who had previously attempted suicide, 17 (48.6%) subjects died as a result of a firearm injury to the head, and 11 (31.4%) victims

selected hanging. Suicidal ideation, expressed either verbally or through writing, was noted in 33.3% and 31.1% of victims in each group, respectively. A total of 19 (17.6%) victims in the younger group had composed a suicide note. In contrast, only 30 (8.4%) subjects in the older group had left a note articulating their suicidal thoughts. Three individuals in this study had experienced a suicidal death of a family member. A 14-year-old boy followed in his brother's footsteps, the latter having committing suicide 4 months previously. A 20-year-old man succumbed to a self-inflicted cranial firearm injury as his mother had before him. A 22-year-old man in this study committed suicide as his great-grandfather had several years previously.

Life Stressors Encountered Before the Suicide

Various life stressors emerge as significant antecedent factors in the suicidal death of the adolescent or young adult. Twenty-one (19.4%) subjects ages 11–17 and 80 (22.3%) victims ages 18–24, respectively, experienced domestic strife, respectively, marked by arguments with family and friends. In the age group 11–17, five (4.6%) victims had encountered legal difficulties; two committed suicide while incarcerated. In the age group 18–24, 37 (10.3%) subjects had been involved in legal problems; seven committed suicide in confinement. A very small percentage of victims experienced employment or financial difficulties. Investigation failed to discover a specific stressor among the remaining decedents.

The Youngest Suicide Victims

Among this cohort aged 11–17 years were five 11-year-olds who committed suicide between 1993 and 2002. All of the victims were males; three were Caucasian, two African American. Three of the boys died as a result of hanging, and two from a cranial gunshot wound. Only one of the boys had exhibited potential warning signs in the days before his death. He had been suspended from school for 1 week because of fighting. He was grounded by his parents, and a school conference had been scheduled. The coroner in the jurisdiction of another boy's death reported that the youngster had been a “good student [with] good spirits” who was “known to fake injuries”; he was found hanging by a dog leash at his home. Only one 11-year-old had written a suicide note, which detailed instructions that he wished to be cremated and buried in another state.

Discussion

Trends of Adolescent and Young Adult Suicide

Evaluation of trends in adolescent and young adult suicide in the United States during the 20th century reveals numerous salient features categorized according to sex, race, and preferred method of suicide. Between 1940 and 1980, the suicide rate in the United States for Caucasian males aged 15–19 more than tripled, representing a 231% increase, and more than doubled for Caucasian males aged 20–24, a 116% increase (18). During this same time period, the rate increased by 262% for non-Caucasian males aged 15–19 and increased by 182% for non-Caucasian males aged 20–34. While not as drastic as that of their male counterparts, the suicide rates for Caucasian and non-Caucasian females steadily increased from 1940 to 1980. Youth suicides (ages 15–24) constituted 5.8% of all suicide deaths in the United States in 1950, which increased to 19.5% of suicides by 1980 (11).

Between 1980 and 1992, the suicide rate increased by 28.3% in the age group 15–19 years, which included a 165.3% rate increase

TABLE 5—Toxicological analysis in suicides ages 11–24 examined in Kentucky Medical Examiners' Offices, 1993–2002.

Psychoactive Substance	Number of Victims	
	Ages 11–17 (n = 108)	Ages 18–24 (n = 358)
Blood	102 (94.4%)	337 (94.1%)
Negative	64 (62.7%)	136 (40.3%)
Ethanol		
Negative	85 (83.3%)	199 (59.1%)
< 0.1%	9 (8.8%)	48 (14.2%)
0.1%	8 (7.8%)	90 (26.7%)
Benzodiazepines	5 (4.9%)	28 (8.3%)
Opiates	0	20 (5.9%)
Antidepressants	4 (3.9%)	17 (5.0%)
Urine	81 (75.0%)	263 (73.5%)
Negative	58 (71.6%)	145 (55.1%)
Cannabinoids	18 (22.2%)	82 (31.2%)
Cocaine/metabolite	1 (1.2%)	22 (8.4%)

for African American males (19). The suicide rate rose by 120% among persons aged 10–14 for both sexes and in all racial groups. During 1992–2001, the suicide rate for individuals aged 10–19 declined from 6.2 to 4.6 per 100,000 population (20,21). In 2002, the compilation of all suicidal causes of death attained the second highest ranking of mortality after unintentional injury among persons ages 11–17 and accounted for 954 (9.5%) of the total 10,027 deaths; it was determined to be the third highest mortality ranking after unintentional injury and homicide for persons ages 18–24, constituting 3300 (12.4%) of the total 26,516 deaths (20).

Methods of Adolescent and Young Adult Suicide

The patterns and methods of adolescent and young adult suicide have varied considerably over the past 30 years in the United States. In 1970, a greater percentage of females ages 15–24 committed suicide by poisoning compared with other methods (11). By 1972 and continuing through the end of the 20th century, firearms were the most common method used by females of this age group (11,20). In 2002, an equal number of females ages 15–24 committed suicide either by firearm or by asphyxia, primarily hanging. Firearm injury remained the leading cause of suicidal death, followed by asphyxiation via hanging, suffocation, and strangulation, for males ages 15–24 between 1970 and 2002 (11,20). However in 1997, asphyxiation surpassed firearms as the preferred suicidal method of adolescents ages 10–14 (21).

Death by firearm was the leading cause of suicide in this study for both males and females, accounting for 72.2% of deaths ages 11–17 and 70.7% of fatalities ages 18–24 (Tables 3 and 4). The distant second and third most common causes of suicidal death were similar for the two age groups, specifically, hanging (22.2% and 18.7%) and overdose (2.8% and 5.3%). Of the individuals dying of a self-inflicted firearm injury, the head was the primary target in the overwhelming majority of cases. Unlike an overdose or a forearm incision, which may represent desperate cries for help without a determination to die, a cranial gunshot wound is more likely to cause death.

Our study, in most respects, mirrors previous studies of adolescent suicide regarding race, sex, and method of suicide (Table 6). Lee et al. conducted a 10-year retrospective review (1988–1998) of 31 suicides ages 11–17 at the Charleston County Medical Examiner's Office in South Carolina (13). Weinberger et al. performed a study of 46 subjects aged 11–16 at the offices of the Los Angeles County Department of Coroner during 1996 and 1997 (22). The Arizona Child Fatality Review Team analyzed several demographic factors associated with 153 suicides ages ≤ 17 between 1994 and 1999 (23). Poteet studied 87 cases of suicide ages of 13–19 at the Shelby County Medical Examiner's Office in Tennessee between 1970 and 1985 (24). These earlier studies evaluated suicides under the age of 20. Our study focused on the younger individuals (ages 11–17). The vast majority of victims in all studies were male, ranging between 74% and 89%. Our study is in accordance with these earlier studies, except that of Weinberger et al., and demonstrates that adolescent and young

adult suicidal deaths most commonly occur in Caucasians with a firearm injury. Weinberger et al.'s study differs from the others by reporting a greatest percentage of hispanics, reflective of the predominant racial mix of the population of Los Angeles County in 1996. Also, the primary method of suicide was almost evenly divided between firearm and hanging.

Firearms and the Risk of Adolescent and Young Adult Suicide

The emerging prevalence of adolescent and young adult suicide by firearm has prompted investigations into the association of the availability of firearms, in particular household firearm ownership, and the increased risk of suicide (25–30). Sloan et al. compared the suicide rate of individuals ages 15–24 between 1985 and 1987 in King County, Washington, to Vancouver, British Columbia (30). The suicide rate was higher in King County, marked by a 10-fold higher suicide rate by handguns. These findings were attributed to the less restrictive firearm laws in the United States compared with Canada.

Grossman et al. (31) conducted a case-control study published in February 2005 featuring gun storage practices and the risk of unintentional and self-inflicted firearm injuries in children and adolescents. These authors concluded there is a statistically significant protective effect of (1) keeping a gun within the home locked and unloaded and (2) storing the ammunition locked and in a separate location. A case-control study of 67 suicide victims under the age of 20 in Pennsylvania between 1986 and 1990 reported a significant association between suicide and the presence of a gun in the home (27). Furthermore, the presence of a gun, principally a loaded gun, was a significant risk factor for suicide in the absence of an identified psychiatric condition. Brent et al. (29) conducted a case-control study specifically detailing firearms within the home consisting of 47 adolescent suicide victims under 20 and two psychiatric inpatient control groups, specifically, 47 suicide attempters and 47 "never-suicidal" psychiatric individuals. They opined that guns were twice as likely to be discovered in the homes of the suicide victims compared with both groups of controls. They attributed the presence of guns in the home to an increased the risk for adolescent suicide independent of firearm type or means of storage.

The Coroner-Medical Examiner System in Kentucky

The Kentucky legislature (KRS Chapter 72) established a Coroner-Medical Examiner system that accords the lay Coroner discretion whether to perform solely an external examination coupled with toxicology or to refer cases to the Medical Examiner's office for autopsy. The coroner may not refer a case to the Medical Examiner for autopsy in certain situations of a highly presumptive suicide based on physical findings at the scene and historical evidence establishing convincing verbal or written suicidal ideation. According to the Center for Disease Control, 680 individuals ages 10–24 committed suicide in Kentucky between 1993 and 2002 (20). During this time period, 466 deaths ages 11–24 were deemed suicidal by the Medical Examiner following a comprehensive

TABLE 6—Demographics and most common method of suicide.

	Gender: Male	Race: Caucasian	Method: Firearm
Our Study (KY) 1993–2002 Ages 11–17 (<i>n</i> = 108)	96 (89%)	95 (88%)	78 (72%)
Lee (SC) 1988–1998 Ages 11–17 (<i>n</i> = 31)	26 (84%)	21 (68%)	24 (77%)
Weinberger (LA) 1996–1997 Ages 11–16 (<i>n</i> = 46)	34 (74%)	14 (30%)	18 (39%)
Azrael (AR) 1994–1999 Age ≤ 17 (<i>n</i> = 153)	128 (84%)	128 (84%)	109 (71%)
Poteet (TN) 1970–1985 Ages 13–19 (<i>n</i> = 87)	69 (79%)	74 (85%)	64 (74%)

review of circumstantial and scene findings and a postmortem examination, reflecting about 68.5% (two thirds) of the total suicide deaths in this age group. Therefore, one third of cases were not referred to the Medical Examiner's office for autopsy.

Toxicological Analysis in Adolescent and Young Adult Suicide: Impact of Ethanol and Antidepressant Medications

Toxicological analysis is an integral component in the death investigation of a presumptive suicide and requires correlation with detailed scene inspection, thorough exploration into the decedent's medical and social background, which may uncover suicidal ideation or intent, and postmortem examination. Ethanol may influence suicidal behavior through a myriad of actions affecting emotion and judgment. Psychological effects may include increased aggressiveness and distress, the removal of barriers during sobriety that protect suicide-prone individuals, and distortion of cognition by impairing the development of coping strategies (32,33). Marttunen et al. (34) studied the psychopathology, specifically depressive disorders and ethanol abuse or dependence, in 53 adolescent suicides ages 13–19 in Finland by means of a psychological autopsy study. Depressive disorders were noted in 34.0% of the victims, and 26.4% had experienced ethanol abuse or dependence. One half of the adolescent suicides were under the influence of alcohol at the time of their demise. Brent et al. (35) conducted a study of 140 suicide victims between ages 13 and 19 in Pennsylvania to determine the role of age and sex on the risk of adolescent suicide. They demonstrated that older suicides (≥ 16 years) were significantly more likely to be intoxicated at the time of the suicide compared with younger victims (37.8% vs. 3.1%). Similarly, in our study, a negative BAC obtained in a greater percentage of adolescents ages 11 to 17 as compared with young adults ages 18–24 (83.3% vs. 59.1%).

The use of antidepressants by youths has substantially increased since the 1990s due primarily to the introduction of selective serotonin reuptake inhibitors (SSRIs: fluoxetine, citalopram, escitalopram, paroxetine, fluvoxamine, and sertraline) and venlafaxine (serotonin and norepinephrine reuptake inhibitors) (36). The Food and Drug Administration reported that approximately 11 million prescriptions for SSRIs and other newer antidepressants were dispensed to individuals younger than age 18 in 2002 (37). The duty of the medicolegal death investigator is to gather and report the toxicological results in all methods of adolescent and young adult suicide; however, the medical examiner or coroner does not bear the responsibility of determining the risks or benefits of antidepressant medications under the current fund of knowledge and experience about them.

This study mirrors earlier reports that antidepressants were detected in the postmortem fluid analysis in only a minority of adolescent and young adult suicides. Gray et al. (38), in a study of 151 individuals aged 13–21 in Utah between 1996 and 1999, documented that only four (3%) of 137 victims had psychotropic medications in their blood, specifically, antidepressants, antipsychotics, or mood-stabilizing medications. In the present study, antidepressant medications were detected in the postmortem blood in four (3.9%) of 108 victims ages 11–17 and in 17 (5.0%) of 358 victims ages 18–24 (Table 5). Interestingly, a substantially greater percentage of victims in both groups were positive for cannabinoids in urine toxicological screening (22.2% and 31.2%).

The Investigation of a Suicide

A comprehensive investigation is warranted in suspected adolescent or young adult suicide. The purpose is to synthesize all

associated sociological, psychological, and pathological findings. A death is ascribed to suicide when evidence supports both the self-inflicted nature and explicit or implicit intent (39). Investigatory evidence of a presumed self-inflicted death includes a thorough scene analysis supported by photographs and diagrams depicting the location of deceased, review of police reports, and examination of victim's medical records. Discussions with the victim's family and friends may shed light on events in the final episode of the decedent's life that may have spurred suicidal thoughts. Such historical and circumstantial assessment, coupled with autopsy and toxicology, often confirms or dispels the likelihood of suicide.

Determination of a suicide relies on the victim's explicit or implicit intention to kill himself or herself and an understanding that the actions are likely to be fatal (39). Explicit intent refers to either verbal or nonverbal expressions indicative of purposeful self-injury. A suicide note constitutes evidence of both explicit intent and the self-inflicted aspect of a suicide. Previous studies report that between 20% and 30% of suicide victims leave suicide notes (40,41). Ho et al. (40) investigated the suicide notes of 154 victims (20.0% of the total 769 suicides) in 1992 in Hong Kong. They determined that young people ≤ 24 years, primarily females, were more likely to leave a suicide note compared with older adults, and that the notes were longer, more emotional, and begged for forgiveness. In the present study, a greater percentage of the victims ages 11–17 wrote a suicide note compared with the young adult group (17.6% versus 8.4%). These low percentages may reflect the aforementioned drawback in the Coroner-Medical Examiner system in Kentucky in which not all cases of presumptive suicide are referred to the Medical Examiner's office for a postmortem examination. The Coroner may independently attribute the manner of death to suicide based solely on the discovery of a suicide note at the scene in conjunction with other historical evidence of suicidal intent without the aid of the Medical Examiner. Implicit intent of suicide refers to indirect evidence such as untimely preparations for death, hopelessness, emotional or physical pain, provisions to elude rescue, or a previous failed suicide attempt (39). A retrospective psychological evaluation ("psychiatric autopsy") by mental health professionals may provide valuable insight into the victim's state of mind and uncover various preexisting life stressors which may have plagued the victim and provoked suicidal ideation (39,42,43).

Conclusion

In summary, the sex, race, method of suicide, and suicidal ideation were strikingly similar between the adolescents ages 11–17 and the young adults ages 18–24 in our study of Medical Examiners' cases of suicide representing two thirds of Coroner cases. While one third of Coroner cases did not undergo autopsy, broad conclusions can be made from this retrospective review. An integrated Coroner-Medical Examiner system profits from more comprehensive data retrieval and analysis for better public health awareness. In the current study, firearm injury, in most cases gunshot wounds of the head, was the primary cause of death in the majority of victims in both groups. The prevalence of self-inflicted gunshot wounds in this young population of our society should prompt further discussion regarding the appropriateness of restricting unsecured household access to firearms. Antidepressant medications were not commonly detected in either group. The safety of prescribing antidepressants to youths is currently an issue of intense public health concern. Suicide prevention is becoming a primary focus in the U.S. Department of Health and Human

Services and the academic arena, which provides recent public awareness about the impact of this U.S. epidemic (44–46).

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